SEA-BIRD SCIENTIFIC

User manual

SBE 11plus V2

Deck Unit for use with SBE 9plus



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Section 1 Safety information

Please read this entire manual before this equipment is unpacked, set up, or operated. Pay attention to all danger, warning, and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

⚠DANGER

Indicates a potentially or imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠WARNING

Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

⚠CAUTION

Indicates a potentially hazardous situation that may result in minor or moderate injury.

NOTICE

Indicates a situation which, if not avoided, may cause damage to equipment. Information that requires special emphasis.

1.1 Hazard information

⚠DANGER

Life-threatening voltages of over 250 VDC are on the sea cable and the Deck Unit when it is on, and will persist for up to 1 minute after it is turned off.

⚠DANGER

Make a separate ground connection between the Deck Unit and an isolated power ground. Connect the separate ground wire from the hull of the ship to the protected ground terminal on the back of the Deck Unit. Use a minimum of 20 AWG wire and a ring terminal.

NOTICE

The manufacturer is not responsible for any damages due to misapplication of misuse of this product including, without limitation, direct, incidental and consequential damages, and disclaims such damages to the full extent permitted under applicable law. The user is solely responsible to identify critical application risks and install appropriate mechanisms to protect process during a possible equipment malfunction.

1.2 Equipment labels

Read all labels and tags attached to the equipment. Personal injury or damage to the equipment could occur if not observed. A symbol on the equipment is referenced in the manual with a precautionary statement.

	Electrical equipment marked with this symbol may not be disposed of in European domestic or public disposal systems. Return old or end-of-life equipment to the manufacturer at no charge to the user.

	EFUP: Hazardous material exists over the threshold of GB/T 26572.2011. The number in the center of the symbol is the Environmentally Friendly Use Period as specified by SJ/T 11364-2014, China's marking for the Restriction of the Use of Hazardous Substances in Electrical and Electronic Products. This product should be recycled after its environmentally friendly use period.

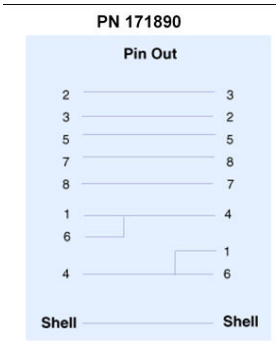
Section 2 Specifications

2.1 Deck Unit specifications

Power requirements	120 VAC at 60 Hz, 1.75 A or 240 VAC at 50 Hz 1 A switchable
Sea cable compatibility	Single- or multi-core armored cable to 10000 m long with inner core resistance of up to 350 ohms
Dimensions	14.3 cm tall, 37.5 cm deep, 44.4 cm wide cabinet. 48.3 cm edge-to-edge for mounting brackets (distance centerline to centerline of mounting holes 46.4 cm)
Operation environment	• indoor use • altitude max: 2000 m • 5 °C to 40 °C • relative humidity max 80% (non-condensing) • Mains supply voltage: ±10%

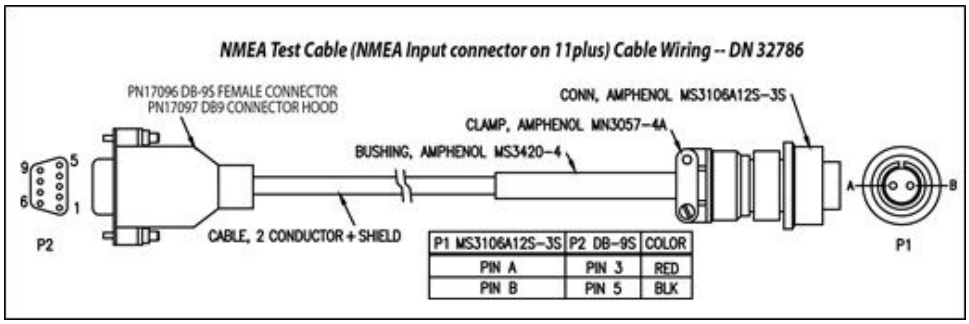
2.2 Cable descriptions

DB-9 to DB-9 null modem cable, serial data uplink



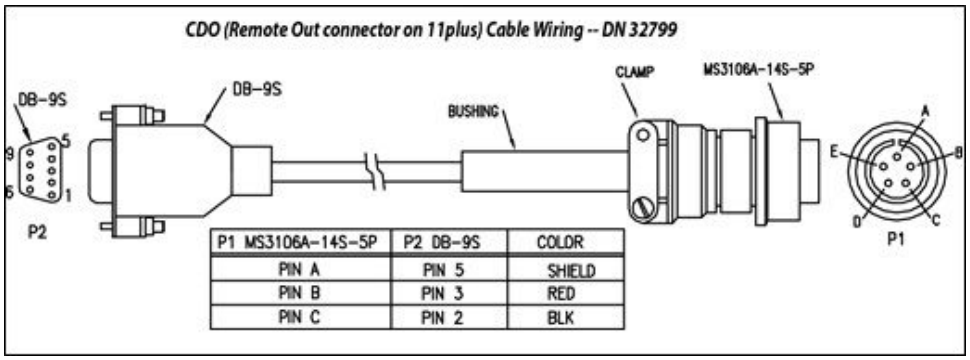
Deck Unit	Function
Pin 3	TX to PC
Pin 5	Common

2-contact to DB9: NMEA input connector on SBE 11 to PC.



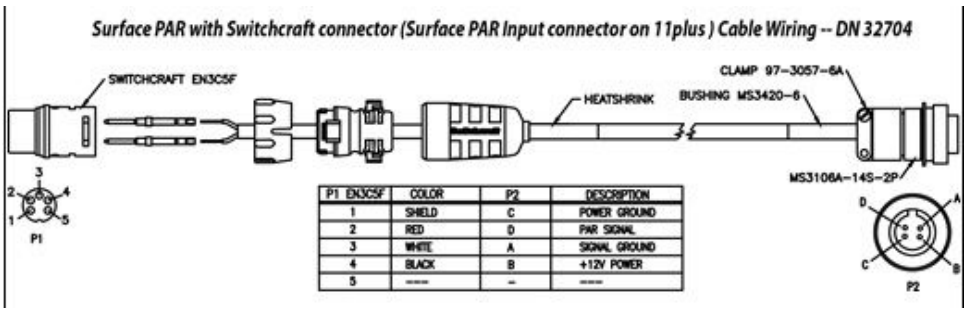
Deck Unit	Function
Pin A	NMEA signal A
Pin B	NMEA signal return B

5-contact to DB9 test cable: remote out connector on SBE 11 to PC



Deck Unit	Function
Pin A	Ground
Pin B	CDO RS232 RX
Pin C	CDO RS232 TX
Pin D	Raw pressure RS232 TX
Pin E	Power, +12 VDC

5-contact to 4-contact: SBE 11 to surface PAR sensor



Deck Unit	Function	Surface PAR
Pin A	Signal ground	Pin 3
Pin B	Power, +12V	Pin 4
Pin C	Power ground*	Pin 1
Pin D	Signal	Pin 2
—	—	Pin 5

* Deck Units with digital PCB assembly 40937C or greater, use pin C.

Section 3 Description of SBE 911plus

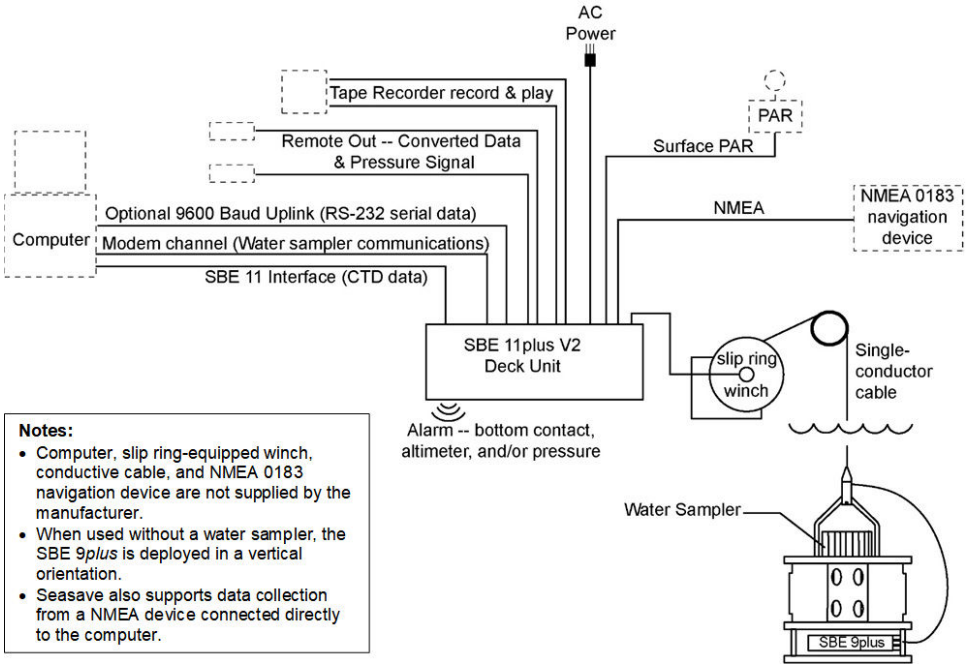
The SBE 11plus V2 is the Deck Unit used with the SBE 9plus CTD for real-time data collection. The 11plus and 9plus can also be used with the 17plus V2 Searam for in-situ data collection.

The Deck Unit supplies DC power to and processes the serial data from the CTD. The Deck Unit uses the RS488 or RS232 standard to transmit the data to a PC. The user can select 120 or 240 VAC at 50/60 Hz for continuous operation that shows on the front panel.

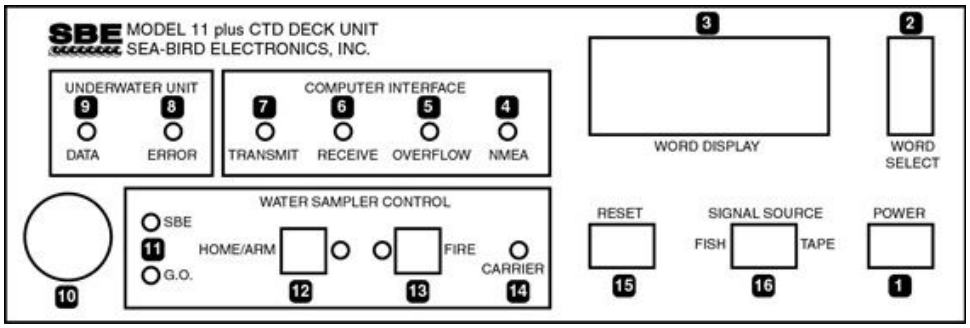
The 11plus Deck Unit functions include—

- A 300 baud modem interface for power and real-time control of a SBE 32 Carousel or G.O. 1010 or 1016 Rosette water sampler or remote serial output device. The modem controls the water sampler through the Deck Unit or the Seasave software. Bottles can be fired in sequence or, for SBE 32 and G.O. 1016, in any order. The interface must be installed in the Deck Unit and CTD.
- An NMEA interface that merges position data and CTD data. The latitude and longitude output from navigation devices that support the NMEA 0183 standard is decoded and appended to the CTD data in the Deck Unit, then transmitted to a PC.
- A/D converter for a surface PAR sensor. The Deck Unit supplies 12 V to the sensor, and merges data from the PAR and CTD.
- Tape recorder to record the digital data on a cassette recorder or VCR.
- Two remote output options:
    - The Deck Unit transmits pressure frequency and pressure temperature 24 times per second, and can be used to control a towed vehicle.
    - Any combination of temperature, conductivity, pressure, depth, salinity, sound velocity, and altimeter height, in engineering units.
- An audible alarm, based on data from an optional bottom contact switch connected to the CTD. Data from an altimeter connected to the CTD can also be used.
- An optional RS232 serial data interface that transmits data from a remote device connected to the CTD. The 300 baud modem must be installed to use this interface.
- Seasoft V2 software, which includes:
    - Seaterm, a terminal program to set up the system.
    - Seasave V7, to collect, convert, and show real-time or stored raw data.
    - SBE Data Processing, to calculate and make plots of conductivity, temperature, pressure, data from auxiliary sensors, and derived measurements such as sound velocity and salinity.

Figure 1 Schematic of 911plus system with water sampler



3.1 Deck Unit front panel



1. Power—turns power to the Deck Unit on or off.
2. Word Select—thumbwheel switch to select any sensor channel data buffer status, or other diagnostics in the Word Display.
3. Word Display—LED display that shows data words such as uncorrected frequencies, A/D voltages and data buffer status.
4. NMEA—LED display that flashes each time an NMEA message is correctly decoded.
5. Overflow—LED display that turns on when the output buffer has overfilled because the PC did not take data from the Deck Unit fast enough. When this occurs, some data is lost and cannot be retrieved. The LED stays on until the Reset button is pushed or a "reset" command is received.
6. Receive—LED flashes when the Deck Unit receives characters from the PC.
7. Transmit—LED flashes when the Deck Unit transmits data to the PC.
8. Error—LED flashes when data from the CTD is incorrect, for example, the modulo count shows a skipped scan.
9. Data—LED stays on when data is received by the Deck Unit.
   - In general, if the Data LED is on and the Error LED is off, the CTD and telemetry link function correctly.
10. Alarm—Buzzer that comes on based on alarm logic for the bottom contact switch.

11. SBE or G.O.—LED stays on to show which water sampler is controlled by SW1 on the Deck Unit or Modem.
12. Home/Arm—Push-button LED. Operation varies for type of water sampler.
13. Fire—Push-button LED. Operation varies with the type of water sampler.
    SBE 32 Carousel

    - The **Home/Arm** button resets the Carousel so it will close the bottle at position #1 the next time the **Fire** button is pushed. When the Deck Unit receives confirmation from the Carousel, the Home/Arm LED comes on and stays on until you fire the first bottle.
    - The **Fire** button causes the Carousel to fire and closes the next position bottle. When the Deck Unit receives confirmation from the Carousel, the Fire LED comes on and stays on until the next time you push **Fire** or **Home/Arm**.
    - When the Carousel is fired from the software, the Fire LED comes on for 5 seconds after the Deck Unit receives confirmation from the Carousel.

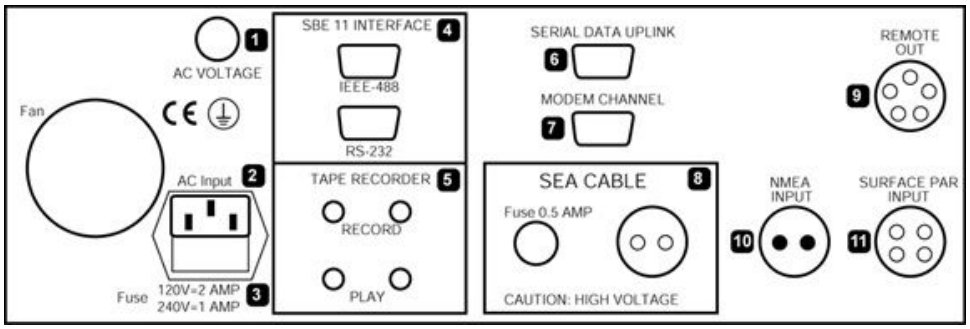
    G.O. 1015 Rosette

    - The **Home/Arm** button turns on the Rosette. The LED comes on 15 seconds later, when the Deck Unit receives confirmation from the Rosette that the pylon is turned on and is ready to fire. The Home/Arm LED stays on until you push the **Fire** button. **You must turn on the power to the Rosette each time you fire a bottle.**
    - The **Fire** button causes the Rosette to fire and closes the next bottle. When the Deck Unit receives confirmation from the Rosette, the Fire LED comes on and stays on until the next time you push Home/Arm. **The Fire button is active only when the Home/Arm LED is on.**
    - When the Rosette is fired from the software, the Fire LED comes on for 5 seconds after the Deck Unit receives confirmation from the Rosette.

    G.O. 1016 Rosette

    - The **Home/Arm** button resets the Rosette and causes the arm to move to the Home position, ready to fire bottle #1 with an offset specified by SW1 on the Deck Unit Receiver/Modem. When the Deck Unit receives confirmation from the Rosette that the pylon is turned on and is ready to fire. The Home/Arm LED comes on and stays on until you fire the first bottle.
    - The **Fire** button causes the Rosette to fire and closes the next bottle. When the Deck Unit receives confirmation from the Rosette, the Fire LED comes on and stays on until the next time you push **Home/Arm**.
    - When the Rosette is fired from the software, the Fire LED comes on for 5 seconds after the Deck Unit receives confirmation from the Rosette.
14. Carrier—LED comes on and stays on when the Deck Unit modem receives a signal from the CTD modem. This applies to communication with water sampler or remote serial sensor.
15. Reset—Push this button to reset the system: the output buffers are erased and input stops until instructions are received from the PC. Always push **Reset** before a CTD cast. If the system is not reset, old data from a previous cast may be the first transmitted to the PC. The Seasave software does this reset automatically before each cast.
16. Signal Source—Put this switch in "Fish" position to get data from the CTD. Put the switch in "Tape" position to hear data stored to an audio recorder.

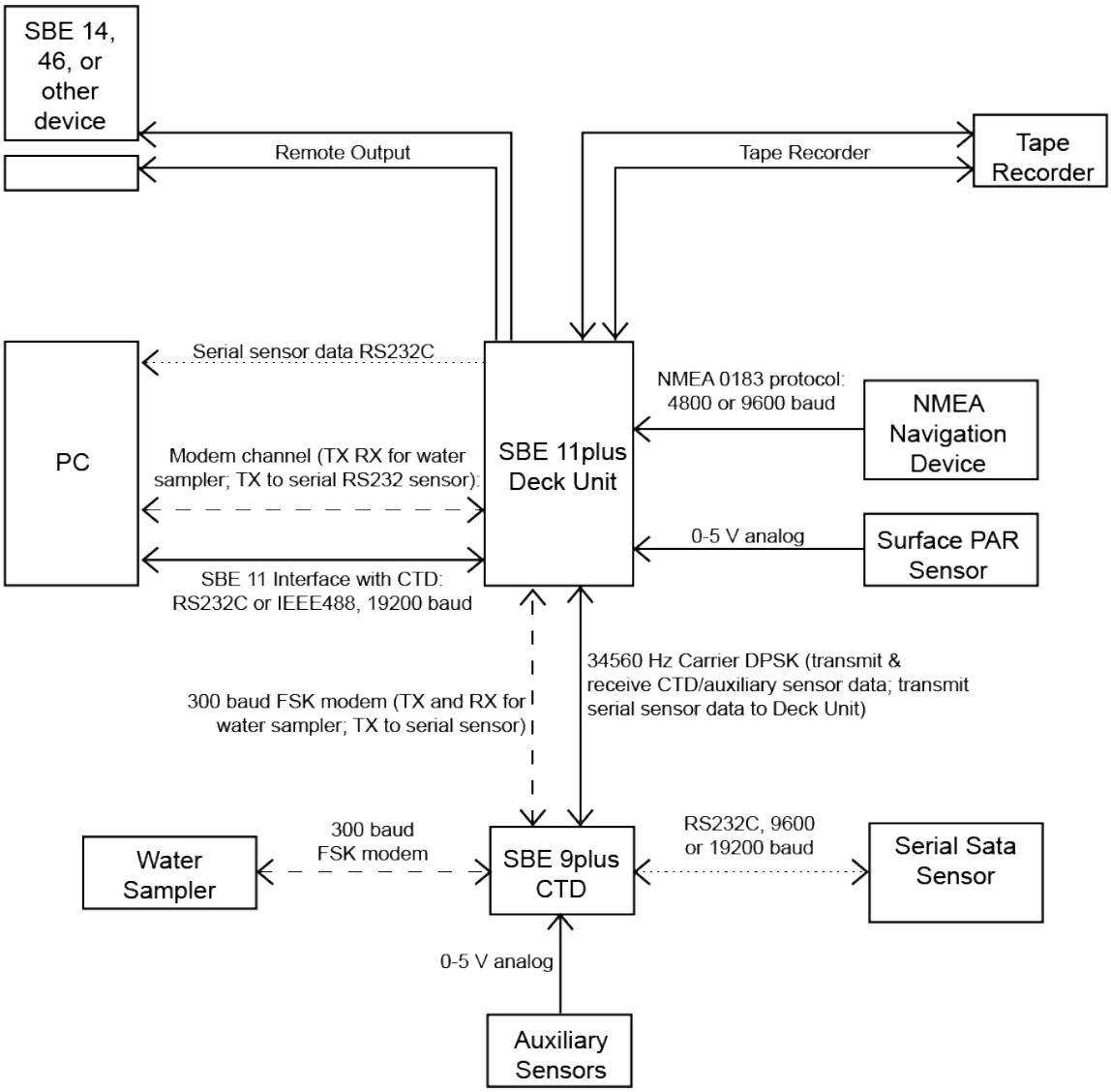
3.2 Deck Unit back panel



1. AC Voltage—Selector switch for 120 VAC at 50 Hz or 240 VAC at 60 Hz.
2. AC Input—Plug for power to Deck Unit.
3. Fuse—5 x 20 mm, 250 VAC Slow-blow; 2 amp for 120 V, 1 amp for 240 V.
4. SBE 11 Interface—Channel between the Deck Unit and the PC. Communicates with the CTD. Note: Seaterm software works with RS232 only.
5. Tape Recorder—Connects to an audio tape recorder or VCR. Connect the tape recorder's "Line In" to the Deck Unit "Record," and "Line Out" to "Play." The two jacks on the Deck Unit are internally connected in parallel, so there is a redundant connection to a typical recorder's stereo channels: recordings are error-free even if the second channel is used for voice annotation.
6. Serial Data Uplink—Gives RS232 output from the Deck Unit for an RS232 sensor connected to the CTD. A modem channel and jumper changes are required. If the jumpers are set for this function, data output cannot occur through the Tape Recorder.
7. Modem Channel—An RS232 connection between the Deck Unit and PC used to communicate with a water sampler.
8. Sea Cable—Connects to CTD. The fuse is 3AG, 300 VDC Fast-acting 0.5 A. Only replace with Littelfuse Corp. 312.500.
9. Remote Out—There are two outputs:
   a. Pressure frequency and pressure temperature, to control a towed vehicle.
   b. Any combination of temperature, conductivity, pressure, depth, salinity, sound velocity, and altimeter height. The output is in engineering units.
10. NMEA Input—Connects to an NMEA 0183 navigation device that can be connected to either the Deck Unit or the PC.
11. Surface PAR Input—Connects to a Surface PAR sensor.

3.3 System communications

This is a graphical summary of the communication for a 911plus system. Note that an NMEA device can be connected directly to a PC in the Seasave V7 version 7.17 and newer.


SBE 14, 46, or other device
Remote Output
Tape Recorder
Tape Recorder
PC
Serial sensor data RS232C
Modem channel (TX RX for water sampler; TX to serial RS232 sensor):
SBE 11 Interface with CTD: RS232C or IEEE488, 19200 baud
SBE 11plus Deck Unit
NMEA 0183 protocol: 4800 or 9600 baud
NMEA Navigation Device
0-5 V analog
Surface PAR Sensor
300 baud FSK modem (TX and RX for water sampler; TX to serial sensor)
34560 Hz Carrier DPSK (transmit & receive CTD/auxiliary sensor data; transmit serial sensor data to Deck Unit)
Water Sampler
300 baud FSK modem
SBE 9plus CTD
RS232C, 9600 or 19200 baud
Serial Sata Sensor
0-5 V analog
Auxiliary Sensors

Section 4 Connect cables on SBE 11plus system

⚠ DANGER

Life-threatening voltages of over 250 VDC are on the sea cable and the Deck Unit when it is on, and will persist for up to 1 minute after it is turned off.

⚠ DANGER

Make a separate ground connection between the Deck Unit and an isolated power ground. Connect the separate ground wire from the hull of the ship to the protected ground terminal on the back of the Deck Unit. Use a minimum of 20 AWG wire and a ring terminal.

4.1 Cable, winch, deck gear

The manufacturer of the Deck Unit does not supply winches and deck gear and does not have recommendations for a block or A-frame.

Cable

Only one conductor is required for the armored cable, because the armor is used as a ground. The total two-way resistance should be less than 350 ohms. The mechanical requirements are affected by the properties of the winch and the weight of the system to be lifted.

Winch

The winch should have a level-wind device that is adjustable or designed to lay the correct number of wraps across the drum. The cable diameter and the drum width determine this value. The winch must have a slip-ring, (a contact that rotates) assembly (at least two channels). The cable must have a break strength of at least 5 to 7 times the maximum load. The user must make the mechanical and electrical cable terminations at the underwater end.

4.2 Connect system components

The manufacturer supplies metal tabs ("ears") to attach the Deck Unit to a standard 19-inch electronic bay. Make sure that the cooling fan and the vent are not blocked.

On a ship, cables longer than 3 m should be installed inside a grounded metal conduit by a qualified electrician. This decreases the possibility of external signals to disrupt communication and protects high voltage lines such as the sea cable.

CTD to Deck Unit

Terminate the sea cable leads from the winch slip rings with the manufacturer-supplied MS3106A12S-3P connector. Connect the inner conductor of the cable (positive), to pin B and the cable armor (negative) to Pin A. Connect the sea cable connector on the back panel of the Deck Unit. The other end of the sea cable connects to JT1 on the CTD.

PC to Deck Unit

Communication between the PC and the Deck Unit is in two channels. The SBE 11 interface channel (RS232 or IEEE488) sends commands to and receives replies from the CTD. The modem channel sends commands to and receives replies from the water sampler or remote serial sensor, through the CTD. Connect the manufacturer-supplied interface and modem cables on the back panel of the deck unit.

NMEA navigation device to Deck Unit

Connect the NMEA navigation device to the NMEA input connector on the back panel of the Deck Unit with the manufacturer-supplied MS3106A 12S-3S connector. A navigation device can be connected directly to a PC as an alternative.

Surface PAR sensor to Deck Unit

Connect the Surface PAR sensor to the Surface PAR Input connector on the back panel of the Deck Unit. The manufacturer supplies an MS3106A14S-2P connector if there is no cable.

Remote Unit to Deck Unit

Connect to the Remote Out connector on the back panel of the Deck Unit. There are two real-time options:

- Raw pressure—Pressure frequency and pressure temperature, transmitted 24 times/second, to be used to control a towed vehicle.
- Converted data out—any combination of temperature, conductivity, pressure, depth, salinity, sound velocity, altimeter height, in engineering units. The manufacturer supplies a MS3106A14S-5P connector if there is no cable. Some of these parameters will show on the display of a SBE 14 or SBE 46.

Serial Data Uplink to Deck Unit

Connect a PC to the Serial Data Uplink DB9 connector on the back panel of the Deck Unit with the manufacturer-supplied cable.

CTD to auxiliary sensors

Refer to the 9plus CTD user manual for details about the connections to auxiliary sensors.

CTD to water sampler

- SBE 32 Carousel: connect from the JT7 connector on the CTD to the 6-contact connector at the bottom of the Carousel pressure housing.
- G.O. 1015 Rosette: connect from the JT4 connector on the CTD to the Rosette. The polarity is usually set to "reverse" (cable P/N 17196). Cable P/N 17533 is "normal." Make sure that the polarity setting on the G.O. 1015 is the same as the polarity of the cable. Refer to Application Note 35 for details.
- G.O. 1016 Rosette: Connect from the JT7 connector on the CTD to the Rosette.

Power to Deck Unit

NOTICE

Do not connect a Deck Unit set for 120 V to a 240 V power supply. It will cause severe damage to the Deck Unit.

Verify that the Deck Unit back panel power selector switch is in the correct position for the mains power source, either 120 or 240 VAC. Connect power to the AC Input connector on the back panel of the Deck Unit with the manufacturer-supplied cable.

Section 5 Set up and configure system

Seasoft V2 software has several components: Seaterm, a terminal launcher; Seasave V7, for real-time data collection; and SBE Data Processing, to process the collected data.

1. Double-click on SeasoftV2.exe to install the manufacturer-supplied software on the PC.
2. Connect either the RS232, the Remote Out, the Serial Data Uplink, or the Modem Channel to the PC. Note that the IEEE488 interface does not work with Seaterm. Use RS232 to set up sensors in Seaterm.
3. Double-click on Seaterm.exe. If this is the first time that the software is used, a setup dialog box may show.
4. Select the "Instrument Type" and the PC COM port, then push **OK**.
5. In the main window, select **Configure**.
6. Select the interface connected to the PC:
   - SBE 11 Interface—RS232 used for general Deck Unit setup.
   - SBE 11 Modem
   - SBE 11 Remote Out—used to set up the Converted Data Output.
   - SBE 11 9600 Baud Uplink—used with the Serial Data Uplink.

   The Configuration window shows.
7. Select the COM Port. The Baud Rate is 9600. The Data Bits is 8, and Parity is None. The Mode is RS232. Push **OK**.
8. Turn on power to the Deck Unit.
9. Send the "Display Status" (DS) command.
   The display in Seaterm:
   ```
   SBE 11plus V 5.2
   number of scans to average = 8
   pressure baud rate = 9600
   NMEA baud rate = 4800
   surface PAR voltage added to scan
   A/D offset = 0
   GPIB address = 1
   advance primary conductivity 0.073 seconds
   advance secondary conductivity 0.073 seconds
   autorun on power up is disabled
   ```
   If the system does not respond as shown, verify that the correct interface was selected and settings were entered correctly in the Configuration Options window, and that the cable between the PC and the Deck Unit is correctly attached.
10. Use the other Seaterm commands to change the setup as necessary.

5.1 Seaterm commands

Notes:

- An `S>` prompt shows that the Deck Unit is connected to the PC and is ready for commands.
- Commands can be entered in upper or lower case.
- When the PC is connected to the *SBE 11 Interface*, the software does not show ("echo") commands. To make sure commands were received and interpreted correctly, send **DS** to see the settings.

Status

DS	Show model and firmware version
	SBE 11plus V 5.2
	number of scans to average = 8 (set to 1 for full data rate of 24 Hz)
PBaud=	pressure baud rate = 9600
NMEABaud=	NMEA baud rate = 4800
AddSPAR=	surface PAR voltage added to scan
Offset=	A/D offset = 0
GBIB=	GPIB address = 1
AdvanceC0=	advance primary conductivity 0.073 seconds
AdvanceC1=	advance secondary conductivity 0.073 seconds
AutoRun=	autorun on power up is disabled

IEEE488

GPIB=x	x=IEEE488 address. Default is 1. Must be set to 1 for Deck Unit to work with Seasave.

Conductivity and Voltage Channel Advance

These commands align data in time, relative to pressure, so calculations of salinity, dissolved oxygen concentration, and other parameters are made from the same parcel of water. Alignment is done in the Deck Unit, so the real-time data that is sent to the software is already aligned. If you save data at the full rate of 24 Hz and additional alignment is required, use the Align CTD module in the SBE Data Processing software to correct the data.

CTD systems that support flow-through sensors such as fluorometers may require different settings. Refer to "Align CTD" in the SBE Data Processing manual and Application Note 38 to calculate optimal advance values.

AdvanceCn=x	n=conductivity channel number, 0 or 1
	x=time, seconds, to advance conductivity channel—measurement on a water parcel is delayed because the TC duct lets water into the sensor after the water as passed the temperature sensor. The delay is constant since the pump sets a constant flow speed. To compensate for the delay so salinity can be calculated with minimum spiking, the Deck Unit can advance the conductivity measurement in time to coordinate it with the applicable temperature measurement. This occurs before any averaging, so a bias error is not introduced in the calculated salinity. Manufacturer-set default for 9plus = 0.073 sec (1.75 scans × 1/24).
Example: set advance for primary and secondary conductivity channels to 0.073. AdvanceC0=0.073 AdvanceC1=0.073	

AdvanceVn=x	n=A/D channel number, 0–7
	x=time, seconds to advance A/D channel, maximum 10 seconds. Advance A/D channels for auxiliary sensors as needed. Refer to specifications for details on time constants. SBE 43 oxygen data is frequently delayed with respect to pressure. The two primary causes are the long time constant of the oxygen sensor (range is 2 seconds at 25 °C to approximately 5 seconds at 0 °C) and an additional delay from the transit time of water in the pumped plumbing line. This delay can be corrected if oxygen data is changed relative to pressure. Typical advance for a SBE 43 used with a SBE 9plus is 2–5 seconds.
Example: set advance for A/D voltage channel 0 to 2 seconds, and A/D channel 4 to 0.04. AdvanceV0=2.0 AdvanceV1=0.04	

NMEA baud rate

NMEABaud=x	x= baud rate for communication between the Deck Unit and the NMEA navigation device, 4800 or 9600.

Surface PAR

AddSPAR=x	x=Y: Add Surface PAR voltage to CTD data. x=N: do not
Offset=x	x=offset voltage, 0–99, used to adjust Surface PAR data for drift in Deck Unit electronics

Pressure baud rate

PBaud=x	x=baud rate for pressure frequency and pressure temperature output from Deck Unit. Available rates: 1200, 2400, 4800, 9600, 19200.

Autorun

AutoRun=x	x=yes: When power is supplied, automatically send GR to start data collection where data is transmitted into the RS232C buffer. Do not send and show the response of the status command when power is supplied. x=n: Default. Wait for a command when power is supplied.
AddNMEA=x	x=y: Add 7 bytes of Lat-Lon data to CTD data. x=n: Do not add Lat-Lon data to CTD data. Only if AutoRun=y. When AutoRun=n, the software automatically sends NY or NN to enable or disable NMEA data, based on the setting in the .xmlcon or .con configuration file.

5.2 Set up and configure CTD

The .xmlcon or .con configuration file gives information about the sensor, channels, serial numbers, and calibration dates and coefficients that the CTD requires. The Seasave software uses this file to interpret and process data. Information in the .xmlcon or .con file must be the same as the actual sensor configuration or data will not be processed correctly.

1. Double-click on Seasave.exe to start the program.
2. Select the **Configure Inputs** menu item.
3. In the *Instrument Configuration* tab, push **Open**.
4. In the dialog box, select either the .xmlcon or .con file and then push **Open**.
5. The configuration information shows on the *Instrument Configuration* tab. Verify that the sensors listed are the same as the sensors on the system and that any auxiliary sensors have the correct channels.
6. Push **Modify** to change the configuration or to see or change the calibration coefficients.

5.3 Set up and configure NMEA

The Deck Unit has an NMEA interface that merges position and CTD data. Messages from navigation devices that support the NMEA 0183 protocol include GGA, GLL, RMA, RMC, and TRF NMEA and are automatically decoded by the Deck Unit.

The decoded latitude and longitude data is appended to the CTD data in the Deck Unit and transmitted to the PC to be stored and/or shown with CTD data. The NMEA LED light on the Deck Unit flashes each time data is successfully decoded. This is typically the same rate that the NMEA data is transmitted. The Deck Unit appends the same NMEA data multiple times, until a new message is decoded.

- If the Deck Unit communicates with the PC with IEEE488, the navigation data is appended to each CTD scan transmitted from the Deck Unit to the PC.
- If the Deck Unit communicates with the PC with RS232, the navigation data is transmitted once per second. In Seasave, the navigation data is then appended to each CTD scan, so the data is the same as the IEEE488.

Example: The CTD operates at 24 Hz and data is not averaged. A navigation device transmits the NMEA data every 5 seconds. The NMEA LED flashes every 5 seconds.

- If IEEE488 is used to communicate with the PC, the same message is appended to each scan of CTD data within that 5 seconds (24 scans/second × 5 seconds = 120 scans that show the same NMEA data).
- If RS232 is used to communicate with the PC, the same message is transmitted 5 times (for instance after CTD scans 1, 25, 49, 73, and 97). The same data is then appended to each scan of CTD data within that 5 seconds.

Note that this section does not apply to data from an NMEA device that is connected directly to a PC. The data is the same.

1. Connect the *SBE 11 Interface RS232* connector to the PC.
2. Double-click on Seaterm.exe to start the software.
3. Select the "Instrument Type" and the PC COM port, then push **OK**.
4. In the main window, select **Configure**.
5. Select SBE 11 Interface.
   The Configuration window shows.
6. Select the COMM Port. The Baud Rate is 9600. The Data Bits is 8, and Parity is None. The Mode is RS232. Push **OK**.
7. Turn on power to the Deck Unit.
8. Send the "Display Status" (DS) command.
   Seaterm shows:

```
SBE 11plus V 5.2
number of scans to average = 8
pressure baud rate = 9600
NMEA baud rate = 4800
surface PAR voltage added to scan
A/D offset = 0
GPIB address = 1
advance primary conductivity 0.073 seconds
advance secondary conductivity 0.073 seconds
autorun on power up is disabled
```

9. Check the NMEA baud rate. If necessary, send NMEABaud= to change the baud for communication bewtween the Deck Unit and the NMEA device, to 4800 or 9600.
10. Turn off the Deck Unit.

5.3.1 Test NMEA in Seasave

Verify the NMEA shows position data in the Seasave software before deployment.

1. Make connections:

- Connect the *SBE 11 Interface RS232* connector on the Deck Unit to the PC. If this connection is not made, noise on the open Sea Cable connector will cause interference with the Deck Unit communication.
- Connect the *NMEA* connector to the NMEA navigation device.
- Connect the *Sea Cable* connector to the CTD.

2. Double-click on Seasave.exe to start the software.
3. Select **Configure Inputs...**.
4. In the *Instrument Configuration* window, push **Open** to see the configuration file for the sensor.
5. Verify that the configuration file shows that the NMEA position data is to be added. If the .xmlcon or .xml file do not show that NMEA position data is to be added, latitude and longitude will not be available as variables in the fixed, scrolled, or plot display. *NMEA Display* will not be available in the **Display** menu.
6. Select **Display** in the main window, then *NMEA Display*.
7. Start real-time data collection:
   - Select *Start* in the **Real-Time Data** menu.
   - Push **Start** in the *Start Real-Time Data Acquisition* window. Latitude, longitude, and the time show in the software. The NMEA LED on the Deck Unit should flash each time the position data is decoded correctly. If position data does not show, verify that the Deck Unit and NMEA device are connected with the correct cable.

5.3.2 NMEA interface commands

Use Seaterm to transmit the command listed below.

Baud rate

NMEABaud=x	x=baud rate for communication between the Deck Unit the NMEA navigation device, 4800 or 9600.

Diagnostic

Use to look at navigation data, to verify that the NMEA device and the interface in the Deck Unit operate correctly. Latitude and longitude data is hex, converted to ASCII:

LAT 47 37.51 N

LON 122 09.41 W

If NMEA message RMC is decoded, the data and time show on the next line with:

DDMMYY HHMMSS

NSR	Transmit Lat and Lon data over RS232 SBE 11 Interface to PC. One scan of NMEA data shows in Seaterm.

NSI	Transmit Lat and Lon data over IEEE488 SBE 11 Interface to PC. One scan of NMEA data shows in Seaterm.

Sent Automatically by Seasave

This command is sent automatically by the software to configure the Deck Unit, based on the setting for "NMEA position data added" in the CTD .xmlcon or .con file. This setting is not stored in the EEPROM of the Deck Unit. The command remains in effect until the **Reset** button on the Deck Unit is pushed, or a new command is sent.

If "NMEA position data added" is selected in the CTD configuration file but the Deck Unit is not connected to a NMEA navigation device, the software will give an error message when you try to start data collection.

If "NMEA position data added" is selected in the CTD configuration file, the software automatically sends NSR or NSI at the start of the cast, and puts NMEA data in the data file header.

Nx	x=y: Add latitude and longitude data to CTD data.
	x=n: Do not add latitude and longitude data to CTD data.

5.3.3 NMEA message format

- -- is two device-specific characters.
- <CR> is carriage return.
- <LF> is line feed

GCA—Global Positioning System Fix Data

Time, position, and fix-related data for a GPS receiver.

$--GCA,hhmmss.ss,llll.ll,a.yyyyy.yy,b,x,xx,x.x,x.x,M,x.x,M,x.x,xxxx×hh<CR><LF>

GLL—Geographic Position, Latitude and Longitude

Latitude and longitude of current position, time of position fix, and status.

$--GLL,llll.ll,a,yyyyy.yy,b,hhmmss.ss,A*hh<CR><LF>

RMA—Recommended Minimum Specific LORAN-C Data

Position, course, and speed data from a LORAN-C receiver.

#--RMA,A,llll.ll,a,yyyyy.yy,b,x.x,x.x,x.x,x.x,x.x,x.x,a*h<CR><LF>

RMC—Recommended Minimum Specific GPS/TRANSIT Data

Time, date, position, course, and speed data from a GPS or TRANSIT navigation receiver.

$--RMC,hhmmss.ss,A,llll.ll,a,yyyyy.yy,b,x.x,x.x,ddmmyy,x.x,a*h<CR><LF>

TRF—TRANSIT Fix Data

Time, date, position, and information related to a TRANSIT fix.

$--TRF,hhmmss.ss,ddmmyy,llll.ll,a,yyyyy.yy,b,x.x,x.x,x.x,xxx,A*h<CR><LF>

Field Type	Symbol	Description
Status	A	Single character field: A = Yes, data valid, warning flag clear V = No, data invalid, warning flag set
Latitude	llll.ll	Fixed/Variable length field: degrees|minutes. Decimal—two fixed digits of degrees, two fixed digits of minutes, and variable number of digits for decimal-fraction of minutes. Leading zeros are always included for degrees and minutes to keep the fixed length. Decimal point and related decimal-fraction are optional if full resolution is not required.
	a	N or S
Longitude	yyyyy.yy	Fixed/Variable length field: degrees|minutes. Decimal—two fixed digits of degrees, three fixed digits of minutes, and variable number of digits for decimal-fraction of minutes. Leading zeros are always included for degrees and minutes to keep the fixed length. Decimal point and related decimal-fraction are optional if full resolution is not required.
	b	E or W
Time	hhmmss.ss	Fixed/Variable length field: degrees|minutes. Decimal—two fixed digits of degrees, two fixed digits of minutes, and variable number of digits for decimal-fraction of minutes. Leading zeros are always included for degrees and minutes to keep the fixed length. Decimal point and related decimal-fraction are optional if full resolution is not required.
Checksum	*	Optional checksum delimiter
	hh	Optional checksum field: Absolute value calculated by exclusive OR'ing 8 data bits, no start or stop bits, of each character in message, between, but exclusive of $ and *.

5.4 Set up and configure Surface PAR in Seaterm

The Deck Unit has an A/D converter that converts the 0–5 V data from a surface PAR. This data is appended to the CTD data in the Deck Unit and is transmitted to the PC. The Seasave and Data Processing software support several PAR sensors:

- Linear or logarithmic Sea-Bird Scientific PAR
- Biospherical QSR-240, QCR-240, QSR-2200, QCR-2200.

1. Connect the *SBE 11 Interface RS232* connector to the PC.
2. Disconnect the PAR sensor from the Deck Unit.
3. Double-click on Seaterm.exe to start the software.
4. In the **Configure** menu, select SBE 11 Interface. In the *Configuration Options* window verify the settings below:
   - Firmware version 5.0 and above
   - Comm port to PC
   - 19200 baud rate
   - 8 data bits
   - parity: none
   - RS232 mode

   Push **OK** to save the settings and exit the window.
5. Turn on power to the Deck Unit.
6. Send the "Display Status" (DS) command.
   Seaterm shows:

```
SBE 11plus V 5.2
number of scans to average = 8
pressure baud rate = 9600
NMEA baud rate = 4800
surface PAR voltage added to scan
A/D offset = 0
GPIB address = 1
advance primary conductivity 0.073 seconds
advance secondary conductivity 0.073 seconds
autorun on power up is disabled
```

   Shows that PAR is enabled, and that there is an offset to adjust for drift.
7. In the software, send **AddSPAR=y** and **Offset=0** if not already enabled.
8. Set the Deck Unit thumbwheel switch to 9.
9. The number that shows on the Word Display LED is the value to use for the offset. **Send Offset=x**, where **x** is the number that shows.
10. Verify that the LED shows 0. If not, repeat the above step.
11. Turn off the Deck Unit.

5.4.1 Surface PAR commands

Use Seaterm to transmit the commands below.

AddSPAR=x	x=y: add Surface PAR voltage to the CTD data
	x=n: do not add Surface PAR voltage to the CTD data

Offset=x	x= offset voltage counts, 0–99, used to adjust Surface PAR data for drift in the Deck Unit electronics

5.4.2 Set up and configure PAR in Seasave

The Deck Unit adds the data from the Surface PAR into the CTD data. The Seasave software stores and can show the PAR data with the CTD data. The software requires a .xmlcon or .con configuration file to add the PAR data to the CTD data.

To verify or change the configuration file:

1. Start the software.
2. Select the **Configure Inputs** menu.
3. In the **Instrument Configuration** window, push **Modify**. Verify that Surface PAR data is added.

5.5 Set up and configure remote output

There are two remote output options from the *Remote Out* connector on the back panel of the Deck Unit—

- Pressure frequency and pressure temperature
- Converted Data Output (CDO).

5.5.1 Set up and configure pressure frequency and pressure temperature

Pressure frequency and pressure temperature are transmitted at the full CTD data rate of 24 Hz (24 scans/second) and can be used to control a towed vehicle.

5.5.1.1 Pressure frequency and pressure temperature command

Use the Seaterm software to send the command below to the SBE 11 interface.

PBaud=x	x=baud rate for pressure frequency and pressure temperature transmitted from the Deck Unit. Rates are 1200, 2400, 4800, 9600, or 19200.

5.5.1.2 Pressure frequency and pressure temperature data format

Pressure frequency and pressure temperature is transmitted in ASCII hex at the full CTD data rate of 24 Hz. Five bytes are ASCII-encoded, with each byte sent as two ASCII characters. Each scan ends with <CR><LF>.

The first six characters are 3 bytes of pressure frequency:

pressure frequency = byte[0] × 256 + byte[1] + (byte[2] ÷ 256)

The last three characters are the 12-bit pressure temperature compensation number:

pressure temperature = M ×12-bit temperature compensation number + B

For example:

Raw pressure scan = 80E8811A81<CR><LF>

byte[0] = 80 hex = 128 decimal

byte[1] = E8 hex = 232 decimal

byte[2] = 81 hex = 129 decimal

Pressure frequency = 128 × 256 + 232 + 129 ÷ 256 = 33000.504 Hz

The 12-bit temperature compensation number = A81 hex = 2689 decimal. If M = 0.01258 and B = -9.844 (from .xmlcon or .con file), pressure temperature = 0.01258 × 2689 - 9.844 = 23.98 °C.

5.5.2 Set up and configure Converted Data Output (CDO)

CDO can be any combination of temperature, conductivity, pressure, depth, salinity, sound velocity, and altimeter height, in engineering units. A separate CDO microcontroller in the Deck Unit converts the raw CTD data. The microcontroller can also operate an alarm in the remote device based on pressure, altimeter height, or bottom contact.

CDO data automatically shows when the Deck Unit is turned on or reset. The data stops when a line with a <CR><LF> is received by the microcontroller (in Seaterm, push **Enter**.)

1. Connect the *SBE 11 Remote Out* connector to the PC.
2. Double-click on Seaterm.exe to start the software.
3. In the main window, select **Configure**.
4. Select SBE 11 Interface. The **Configuration** window shows. Select the options:
   a. COM Port—1 through 10.
   b. Baud Rate—300, 600, 1200, 2400, 4800, 9600, 19200.
   c. Data Bits—8
   d. Parity—None
   e. Mode—RS232.
5. Push **OK**.
6. Turn on power to the Deck Unit.
7. Send the "Display Status" (DS) command.
   The display in Seaterm:

Command	Output
	S>DS
	SBE 11plus Remote Output V 1.0
NAvg=	number of scans to average = 4
Alarms=	bottom contact alarm enabled
Alarms=	pressure alarm enabled:
PEnable=	pressure to enable alarm = 100.0 db
PSet=	sound alarm when pressure is less than 50.00 m
Alarms=	altimeter alarm enabled:
PEnable=	pressure to enable alarm = 100.00
AltSet=	sound alarm when altimeter height is less than 50.00 m
AltHyst=	altimeter hysteresis = 5.0 m
AltVolt=	altimeter vol number = 2
AltScale=	altimeter scale factor = 5.00
Lat=	latitude to use for depth calculation = 30.0
Format=	output format = press depth temp cond sal

   Data will show if power was just turned on.
8. If the system does not respond:
   - Verify that the *SBE 11 Remote Out* was selected and the settings were entered.
   - Verify that the cables between the PC and the Deck Unit are correct and connected correctly.
9. Push the **Enter** key to stop the Deck Unit.
   An S> shows. The system can now receive commands.
10. Send commands to modify the setup as necessary.

5.5.2.1 CDO status commands

DS	Show setup parameters
	Firmware version for Remote Output
	NAvg=number of scans to average. Deck Unit calculates averages and sends this data to the remote output port at this rate. This is not the same as the number of scans to average that shows in the status command response for the SBE 11 interface.
	Alarms=bottom contact alarm enabled?
	Alarms=pressure alarm enabled?
	PEnable=pressure to enable alarm
	PSet=pressure alarm setting
	Alarms=altimeter alarm enabled?
	PEnable=pressure to enable alarm
	AltSet=altimeter alarm setting
	AltHyst=altimeter alarm hysteresis
	AltVolt=altimeter channel
	AltScale=altimeter scale factor
	Lat=latitude to use for depth calculation that shows only if the output format includes depth
	Format=output format. Lists all CDO parameters.

5.5.2.2 CDO coefficients commands

DC	Show calibration coefficients	
	TCalDate=S	S=primary temperature calibration date
	CCalDate=S	S=primary conductivity calibration date
	PCalDate=S	S=pressure calibration date
	TF0=F	F=primary temperature F0
	TG=F	F=primary temperature G
	TH=F	F=primary temperature H
	TI=F	F=primary temperature I
	TJ=F	F=primary temperature J
	CG=F	F=primary conductivity G
	CH=F	F=primary conductivity H
	CI=F	F=primary conductivity I
	CJ=F	F=primary conductivity J
	CPC=F	F=primary conductivity pcor
	CTC=F	F=primary conductivity tcor
	CS=F	F=primary conductivity slope
	PC1=F	F=pressure C1
	PC2=F	F=pressure C2
	PC3=F	F=pressure C3
	PC1=F	F=pressure D1

	PT1=F	F=pressure T1
	PT2=F	F=pressure T2
	PT3=F	F=pressure T3
	PT4=F	F=pressure T4
	PS=F	F=pressure slope
	PO=F	F=pressure offset
	PM=F	F=pressure M
	PB=F	F=pressure B
	AltVolt=N	N=CTD A/D voltage number for altimeter
	AltScale=F	F=altimeter scale factor

F = floating point number
S = String with no spaces
N = integer
Example:

```
S>DC
SBE 11plus Remote Output V 1.0
TEMPERATURE: 24-jun-98s
TF0 = 1.000000e+03
TG = 4.345714e-03
TH = 6.402139e-04
TI = 2.284978e-05
TJ = 2.196164e-06
TOFFSET = 4.500000e+01
CONDUCTIVITY: 25-jun-98s
CG = -1.045817e+01
CH = 1.473827e+00
CJ = 3.846583e-04
CPCOR = -9.570000e-08
CTCOR = 3.250000e-06
CSLOPE = 1.000000e+00
PRESSURE: 5-May-99
PC1 = -5.006884e+04
PC2 = -1.104210e+00
PC3 = 1.561210e-02
PD1 = 4.029500e-02
PT1 = 2.992485e+01
PT2 = -6.269641e-04
PT3 = 4.621850e-06
PT4 = -1.599760e-09
PSLOPE = 1.000000e+00
POFFSET = 3.288600e+04
PM = 1.276324e-02
PB = -9.6809151e+00
```

```
altimeter voltage number = 2
altimeter scale factor = 5.0
```

5.5.2.3 CDO general setup commands

Format=x	x=output format for **x < 128**, add the parameter value *x* to see data from any combination of the parameters below, up to four.

	Parameter	Value
	altimeter height	1
	depth	2
	temperature	4
	conductivity	8
	pressure	16
	salinity	32
	sound velocity	64
	output format for **x > 128**	
	altimeter height	128 + 1 = 129
	depth	128 +2 = 130
	pressure	128 + 16 = 144
	pressure and altimeter height	128 + 1 + 16 = 145
	depth and altimeter height	128 + 1 + 2 = 131

For example:

- Depth only, Format=2.
- Depth, temperature, conductivity, and pressure, Format=30 (2 + 4 + 8 + 16).
- All seven variables, Format=127 (1 +2 +4 + 8 +16 + 32 + 64)

Baud=x	x=baud for CDO; 300, 6050, 1200, 2400, 4800, 9600, 19200

The baud rate must be the same as the baud selected in the Configuration Options of the software or the software will not communicate with the Deck Unit.

NAvg=x	x=number of scans to average for CDO. The minimum is based on output baud and format:
	Minimum NAvg = (24 × NBITS÷baud) + 1 *where* NBITS=100 × number of output variables. The CDO microcontroller verifies that NAvg is greater than or equal to the minimum. If you enter a value that is too low, the microcontroller sets NAvg to the minimum.

Lat=x	x=latitude, in degrees, to use to calculate depth from pressure.
	Minimum NAvg = (24 × NBITS÷baud) + 1

5.5.2.4 CDO diagnostic command

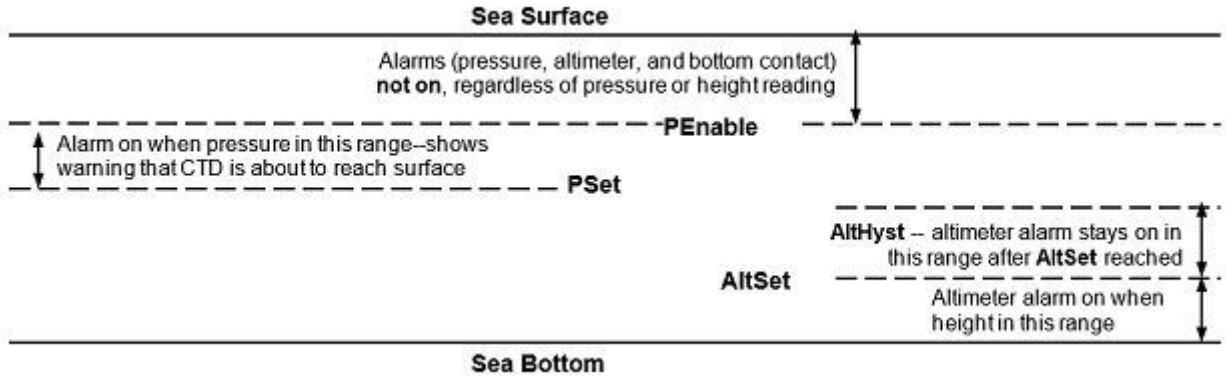
Go or Run	Transmit CDO data to the PC. The data shows in the software in the selected format. Useful for diagnostic purposes. Push **Enter** one or more times to stop data.

5.5.2.5 CDO alarm commands

CDO has three types of alarms:

- Bottom contact—set when the bottom contact bit in modulo word is set and pressure is greater than **PEnable**.
- Pressure—set when pressure is less than **PSet** and greater than **PEnable**.
- Altimeter—set whe altimeter height is less than AltSet and pressure is greater than **AltSet** + **AltHyst**.

An alarm can be set up for the Deck Unit as well. The Deck Unit alarm operates if a bottom contact switch is used with the CTD. This alarm can also be set up to operate based on pressure/altimeter data in the **Configure Outputs** menu of the software.



Alarms=x	x=alarm enable parameter If x=0, all alarms are disabled. Add alarm value *x* to enable any combination of alarms: Bottom contact = 1 Pressure = 2 Altimeter = 4

For example:

To enable the Bottom contact alarm, set **Alarms=1**.

To enable all three alarms, set **Alarms=7** (1 + 2 + 4).

PEnable=x	x=minimum pressure, decibars, to enable all alarms

PSet=x	x= pressure, decibars, to turn on the pressure alarm

AltSet=x	x=distance above bottom, meters, to turn on the altimeter alarm

AltHyst=x	x=maximum change in distance above the bottom, meters, for altimeter hysteresis

5.6 Set up water sampler

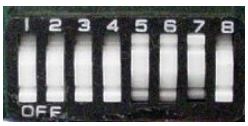
The SBE 32 Carousel water sampler, a G.O. 1015 or G.O. 1015 Rosette use a 300 baud modem to communicate with the SBE 911plus. The modem lets the user control the water sampler through the Deck Unit or the Seasave software. The modem interface must be installed in both the Deck Unit and the CTD.
For the G.O. 1015: the Deck Unit must have the control module in addition to the 300-baud modem interface.

5.6.1 Set up Deck Unit receiver and modem dip switches

Set the switches at SW1, positions 1 through 4:

Water sampler	SW1 position			
	1	2	3	4
SBE 32 carousel	On	On	On	On
G.O. 1015 Rosette	Off	On	On	On
G.O. 1016 Rosette	On	Off	On	On

For a G.O. 1016, set the Arm offset to adjust the "home" position with SW1 positions 5 through 8:



A switch is ON when it is pushed in at the position number. Switches 1, 2, 3, 4, and 8 are On. 5, 6, and 7 are Off.

Arm offset, degrees	SW1 position			
	5	6	7	8
-2.8	On	On	On	On
-2.4	Off	On	On	On
-2.0	On	Off	On	On
-1.6	Off	Off	On	On
-1.2	On	On	Off	On
-0.8	Off	On	Off	On
-0.4	On	Off	Off	On
0.0 (nominal)	Off	Off	Off	On
0.4	On	On	On	Off
0.8	Off	On	On	Off
1.2	On	Off	On	Off
1.6	Off	Off	On	Off
2.0	On	On	Off	Off
2.4	Off	On	Off	Off
2.8	On	Off	Off	Off
3.2	Off	Off	Off	Off

5.6.2 Set up water sampler in Seasave

1. Double-click on Seasave.exe to start the software.
2. Select the **Configure Inputs** menu.
3. Select the *Serial Ports* tab. In the Water Sampling and 911 Pump Control Serial Port area, select the COM port that is connected to the Deck Unit *Modem Channel* connector.
4. Set up the other serial ports. The CTD Serial Port is the port connected to the Deck Unit SBE 11 Interface connector.
5. Select the *Water Sample* tab.
   a. Enter the "Water sampler type":

- SBE Carousel (32, 32C, or 32SC)
- SBE ECO (SBE 55)
- G.O. 1015 or 1016
- Hydro-Bios (custom applications)
- IOW (custom applications)
- None

b. Enter the "Number of Water Bottles" up to 36.

c. Enter the "Firing Sequence":

- Sequential—when commanded to fire, bottles fire in order of position. (Bottle in position #1 fired first, then #2, etc.)
- User Input—when commanded to fire, the user selects which bottle to fire in the software.
- Table Driven—when commanded to fire, bottles fire in order pre-defined by a user-entered table. Push **Bottle Positions for Table Driven** to enter the bottle positions.
- Auto Fire—bottles are fired automatically at user-entered, pre-defined pressures or depth on the **upcast**. Push **Auto-Fire Pressures and Positions** to enter parameters. Auto fire on downcast is available if the -autofireondowncast command line parameter is entered.

d. Put a check in "Enable remote firing" to remotely control when bottles fire through *TCP/IP Ports* tab and NOT by "Firing Sequence."

e. In the Tone for bottle fire confirmation area, select either the internal speaker on the PC or "PC sound card" so the tone can be transmitted to external speakers or headphones.

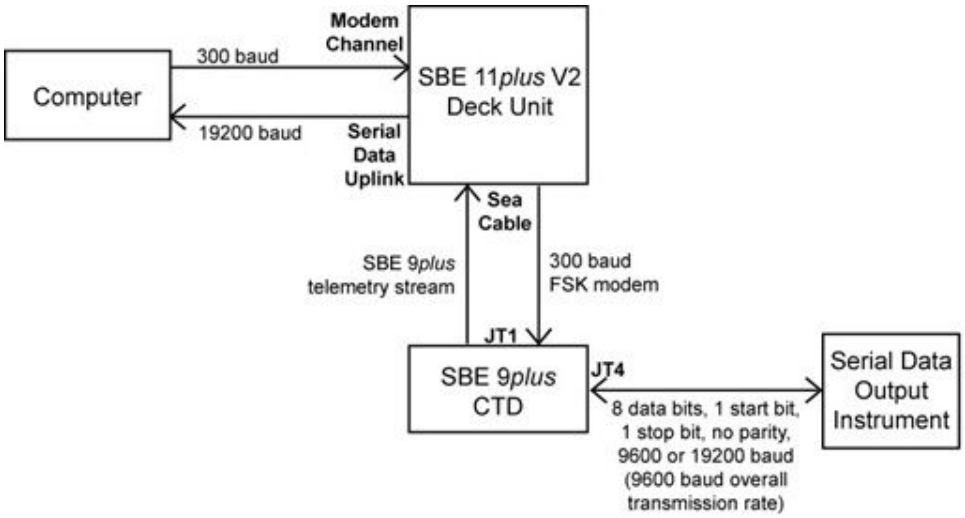
6. Push **OK** to save the settings.

7. Optional: from the main menu, set up a plot window in the software to show the order in which the bottles close, or put a horizontal line in the plot to show the data associated with a bottle closure. Right-click in a **Plot Display** window and select *Modify*.

5.7 Set up RS232 data uplink

The SBE 911plus can have an interface for serial data from a sensor connected to JT4 on the CTD. Serial data is multiplexed into the 9plus telemetry, and is de-multiplexed by the Deck Unit. This data is transmitted from the Deck Unit at the *Serial Data Uplink* connector.

The serial data uplink operates in only one direction, from the CTD to the Deck Unit. Communication from the Deck Unit to the serial data sensor occurs through the 300 baud FSK modem used to control the water sampler. Note: the 911plus supports the use of the serial data sensor and the water sampler in the same cast. Commands sent through the 300 baud modem are transmitted at the transmit rate of the sensor. Data from the serail data sensor is transmitted at 19200 baud.



Notes:

- The *Serial Data Uplink* connector is included on all 11plus V2 with serial number 637 and higher. On older units, the connector was included only if the 11plus V2 had the serial data uplink feature.
- The serial data uplink also requires that the 300 baud water sampler modem channel is installed on both the 11plus V2 and the 9plus CTD.

5.7.1 Serial data sensor requirements

Configure the serial data sensor to transmit data with 1 start bit, 8 data bits, no parity, 1 stop bit, at 9600 baud. The continuous transmission rate can not be more than 9600 baud, so the serial data sensor that transmits at 19200 must be set to burst mode. Burst mode separates transmitted data into intervals with no data transmitted, so that the average data rate is 960 bytes/second, or 9600 baud.

5.7.2 SBE 9plus CTD requirements

The RS232 serial data uplink can be included when the 9plus is ordered or it can be added later by the manufacturer.

Requirements to add the uplink:

- A logic PCB that gives the 9plus control at the normal rate but transmits data to the sea cable at twice the normal rate.
- A modem PCB for the 300 baud FSK modem channel for control of the water sampler. This is also used to for serial data input.
- Change to the backplane wiring.
- A 4-contact JT4 connector on the top of the 9plus to connect to the serial data sensor.

The serial data uplink requires that the 300 baud water sampler modem is installed in both the 11plus and 9plus.

5.7.3 SBE 11plus Deck Unit requirements

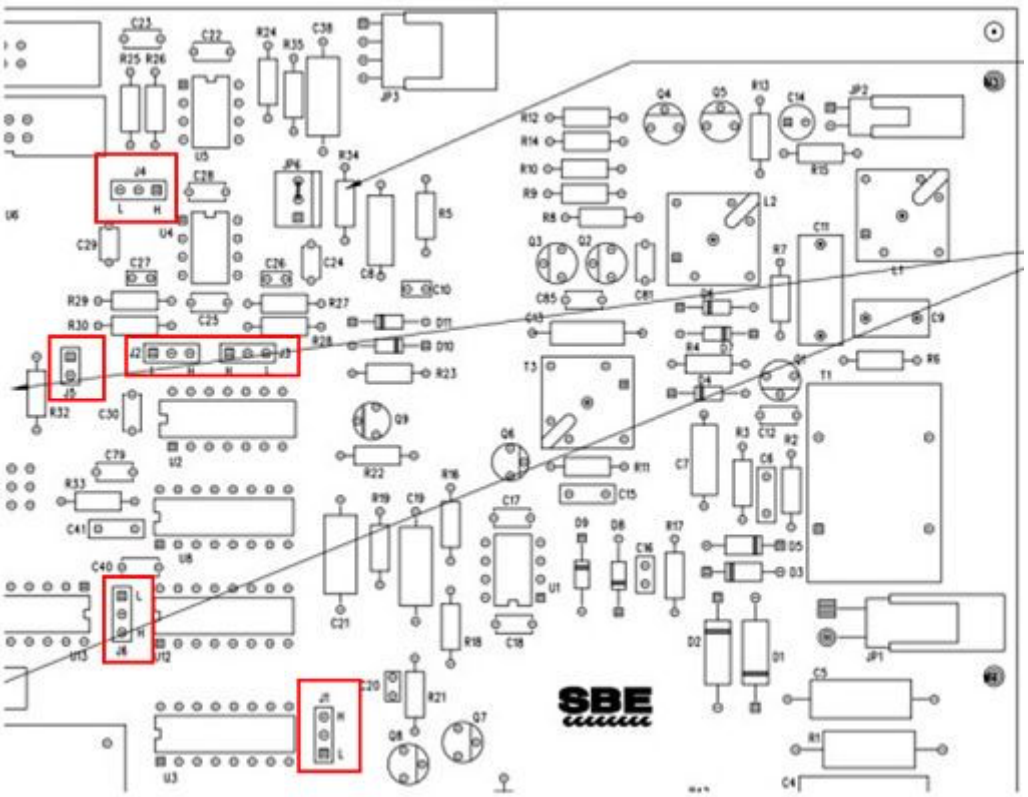
If the Deck Unit has a *Serial Data Uplink* connector, the jumper positions on the 11plus V2 need to be changed to process the multiplexed data.

Remove the bottom cover of the 11plus and set the jumpers on the Reciever/Modem PCB (drawing 41704):

Jumper	Position
J1	H
J2	H

J3	H
J4	H
J5	Short
J6	H

Figure 2 Receiver/Modem printed circuit board jumpers



5.7.4 SBE 911 system limits

There are several limits to a 911plus system that is set up for serial data uplink.

- The maximum sea cable is 8000 m.
- The 9plus cannot be used with a SBE 17plus V2 Searam.
- The 911plus cannot be used with a G.O. 1015.
- A 9plus that has a RS232 serial data uplink is not compatible with an 11plus V2 that is set up for standard transmission.
- An 11plus V2 with jumpers set for serial data uplink cannot transmit data through the *Tape Recorder* on the 11plus V2 back panel.

6.1 Collect real-time data and fire bottles from Seasave

The user can also use the SBE 17plus V2 to save data in memory at the same time as the 9plus data is transmitted real-time through the Deck Unit. This gives a data back-up if there are problems over the sea cable.

1. Double-click on Seasave.exe.
2. If necessary set up display windows and make any other change in **Configure Outputs** and **Configure Inputs**.
3. Turn on the Deck Unit.
4. In the **Real-Time Data** menu, select *Start*.
5. Select the options for data collection and storage in the **Start Real-Time Data Acquisition** window.
   a. Data Archiving Options area:
      - Begin archiving data immediately—store raw (frequencies and voltages) data in real-time when **Start** is pushed.
      - Begin archiving data when "Start Archiving" command is sent—Control when data is written to the file. The user can prevent unwanted scans, such as at the start of a cast.
      - Do not archive data for the cast—data is not saved.

   b. Output data (.hex) file area:
      - Push **Select Output Data File Name** to enter the location and name of the data file to save.

   c. Configuration Options area:
      Shows current .xmlcon or .xml configuration file name and location.
      - Push **Configure Inputs** to change serial ports, water sampler, TCP/IP ports and other inputs.
      - Push **Configure Outputs** to change serial data and ports, shared file outputs, TCP/IP ports, alarms, and other output.

   d. Timeout options:
      - "Timeout in seconds at startup" is the time before the first data is received from the sensor. The software will "time out" and not try to collect data if no data is received within the set time period.
      - "Timeout in seconds between scans" is the maximum interval between scans after the first data is received from the sensor.
6. Push **Start**.
   a. If either of the "Data Archive" options were selected and "Prompt for Header Information" (in the **Configure Outputs** window) was selected, the **Header Information** dialog box shows. Fill in the header information (optional) and push **OK**.
   b. If a water sampler is set up, the software sends a Reset command to it and waits up to 60 seconds to for confirmation. If the water sampler is not confirmed, make sure that the Deck Unit power is on, the PC and the Deck Unit are connected, and the communication settings and COM ports (*Serial Ports* tab) are correct.
   c. If "NMEA position data added" is selected in the .xmlcon or .con file, the software starts NMEA communication.
   d. If either "AddSPAR=y" or "AddSPAR=n" was selected in the .xmlcon or .con file, the software sends that command.
   e. If "Check Scan Length" was selected in the **Options** menu, the software verifies from the .xmlcon or .con file that the scan length is the same as the sensor. If

Scan length error shows, make sure the .xmlcon or .con file is correct and has been updated if sensors have been added or removed, or if NMEA or PAR inputs have been added or removed.

f. The software sends *Waiting for data...*The software will time out if data is not received from the Deck Unit within the "Timeout in seconds at startup" that was set in **Start Real-Time Data Acquisition**.

g. Data starts to show in the display.

7. To fire a water sampler bottle from Seasave, enter **Ctrl F3** or, in the **Real-Time Control** menu, select *Fire Bottle Control*. The **Bottle Fire** window shows. (This can be left open throughout a cast.) The window shows the next bottle to be fired. If *User Input* was selected in the water sampler setup, select the next bottle to fire, then push **Fire Bottle** when ready. If *Auto Fire* was selected (**Configure Inputs** menu, *Water Sampler* tab.)
When the software gets a "bottle fired" confirmation from a water sampler:

SBE Carousel or G.O. 1016—a line is written to a file (with the same filename as the data file) with a .bl extension. This has the bottle fire sequence number, bottle position, date, time and first and last scan number for 1.5 seconds of scans) for the fired bottle.

G.O. 1015—the SBE 9plus sets a bit in the modulo word high for 1.5 seconds, and the software adds an increment to the number of bottles fired.

Later, when the raw data file is converted in the Data Conversion module of the software, the scans in the .bl file or marked with a bottle confirmation bit are written to a water bottle file with a .ros extension.

8. Push **Stop** to stop data collection.

9. Turn off the Deck Unit.

6.2 Fire bottles from Deck Unit

The user can also fire bottles directly from the Deck Unit. The manufacturer strongly recommends that only one method is used, either the software or the Deck Unit, not both, on the same cast. Bottles fired from the Deck Unit are always fired in sequence.

The Seasave software still gets a *Bottle Fired* confirmation from the water sampler if both the *SBE 11 Interface* and the *Modem Channel* are connected to the PC.

- For the SBE 32 Carousel or G.O. 1016 Rosette: Seasave writes a line to an output file with a .bl extension. This file has the bottle fire sequence number, the bottle position, date, time, and start and end scan number (for 1.5 seconds of scans) for the fired bottle.
- For the G.O. 1015 Rosette: the SBE 9plus sets a bit in the modulo word high for 1.5 seconds, and the software adds an increment to the number of bottles fired.

After deployment, when the raw data file is converted in the SBE Data Processing software, the scans identified in the .bl file or marked with a bottle confirmation bit are written to a water bottle file with a .ros extension. The .bl file has the same location and file name as the data file.

6.2.1 SBE 32 carousel

1. Push **Home/Arm** to reset the carousel so it will close the bottle at position #1 the next time **Fire** is pushed. The Home/Arm LED comes on and stays on until the first bottle is fired.

2. Push **Fire**.
The carousel fires bottle #1.

3. Do step 2 to fire each bottle.
The carousel fires bottles in sequence.

6.2.2 G.O. 1015 rosette

1. Push **Home/Arm** to turn on the rosette. The Home/Arm LED comes on 15 seconds later to show that the rosette is ready to fire.
2. Push **Fire** to fire the first bottle.
3. Do steps 1 and 2 to fire each bottle.
   The rosette fires bottles in sequence.

6.2.3 G.O. 1016 rosette

1. Push **Home/Arm** to reset the rosette so it will fire the bottle at position #1 the next time **Fire** is pushed.
   The Home/Arm LED comes on and stays on until the first bottle is fired.
2. Push **Fire**.
   The rosette fires bottle 1.
3. Do step 2 to fire each bottle.
   The rosette fires bottles in sequence.

6.3 Control pump manually

A typical SBE 9plus supplies power to the pump 60 seconds after the conductivity cell is in water with sufficient salt to increase the conductivity cell frequency to above approximately 3500 Hz.
For a 9plus with the manual pump control feature installed, the conductivity cell frequency does not control the pump power. The pump is controlled by PC command through the modem channel connector on the Deck Unit. There is no delay time when power is supplied to the pump. Use the Seasave software to manually control the pump.

1. Select **Configure Inputs**.
2. At the *Instrument Configuration* tab, select the .xmlcon or .con file for the 9plus.
3. At the *Serial Ports* tab, select the COM port for Water Sampling and 911 Pump Control.
   Pump control commands are sent through the 11plus *Modem Channel* connector, but pump control has no effect on the operation of the water sampler.
4. At the *Pump Control* tab, put a check in the "Enable pump on/pump off commands" box.
5. Make any other setup changes, then push **OK**.
6. Turn on the Deck Unit and turn the thumbwheel switch to position `1 1 (B)`.
   There are four digits that show the CTD status. Digits 1 and 3, from right to left are for pump operation.
   - 1st digit is Pump status. 1 = pump on, 0 = pump off.
   - 3rd digit is Manual Pump Control status, in place of G.O. 1015 water sampler confirm signal. 1 = Deck Unit senses that the Manual Pump Control is installed. 0 = no Manual Pump Control is sensed.

   The display should show `0110`—manual pump control is installed, pump is off.
7. At the **Real-Time Data** menu, select *Start...* and make any changes necessary. Then push **Start**.
   Real-time data collection starts.
8. At the start of a deployment, let the system stay in water above the pump intake for 1 minute before a downcast. This lets air escape from the CTD plumbing so that the pump operates correctly.
9. There are two ways to turn the pump on or off:
   - Select "Pump On" or "Pump Off" the **Real-Time Control** menu.

- Push Ctrl-F2 to turn the pump on. Push Ctrl-F4 to turn the pump off.

The pump status on the Deck Unit thumbwheel switch will show—

0**1**11 manual pump control installed, pump on.

0**1**10 manual pump control installed, pump off.

6.4 Process data

The SBE Data Processing software module lets the user convert raw .hex data into engineering units, edit the data, calculate derived variables, and make plots of processed data. Refer to the Data Processing manual for details.
The manufacturer strongly recommends that the user uses the Data Conversion software module to convert data to a .cnv file format before any edits are made.

For applications that do not require all five frequency channels, all eight A/D channels, Surface PAR, and NMEA, channels that are not used can be suppressed if the user makes the appropriate changes to the configuration file. This will reduce the quantity of memory needed to store CTD data.

The Deck Unit and the CTD data are different in several ways:

- The Deck Unit changes the order of the output.
- The Deck Unit automatically removes CTD bytes 31–36, unused or marker bytes, from the data
- The Deck Unit adds Surface PAR and NMEA data if applicable.

Each data word is three bytes:

Word from Deck Unit	Description	Deck Unit thumbwheel switch position
0	Primary temperature	0
1	Primary conductivity	1
2	Pressure	2
3	Secondary temperature	3
4	Secondary conductivity	4
5	A/D channels 0–1	5
6	A/D channels 2–3	6
7	A/D channels 4–5	7
8	A/D channels 6–7	8
9	Surface PAR	9
10	Pressure temperature compensation and modulo count	10 [A]
	CTD status	11 [B]
—	Bytes available in IEEE488 buffer	12 [C]
—	Bytes available in RS232 buffer	13 [D]
appended to end of scan	NMEA data	—

The notation on the switches can be either:

0,1,2,3,4,5,6,7,8,9,10,11,12,13,14,15

0,1,2,3,4,5,6,7,8,9,A,B,C,D,E,F with A–F equal to 10–15.

This manual uses the 1–15 notation, with the other in brackets. For example, "set the switch to 11 [B]."

7.1 Deck Unit LED display format

Select data words with the thumbwheel switch on the Deck Unit. The display updates several times per second. When the thumbwheel is set to a suppressed channel, the LED display is blank.

Switch position	Description	Details
0	Primary temperature	Data shows as a frequency in Hz.
1	Primary conductivity	
2	Pressure	
3	Secondary temperature	
4	Secondary conductivity	
5	A/D channels 0-1	Each switch position shows information from two channels. From left to right, first 4 digits shows lower channel, e.g. V0, and second 4 digits show next channel, e.g. V1. Each voltage shows as a decimal value, N, of a 12-bit number, the binary notation of analog voltage. The display shows 4095 for 0 V and 0 for 5 V. V = 5 (1-[N÷4095])
6	A/D channels 2-3	
7	A/D channels 4-5	
8	A/D channels 6-7	
9	Surface PAR	Voltage shows as a decimal value (N) of a 12-bit number. The display shows 4095 for 0 V and 0 for 5 V. V = N÷819
10 [A]	Pressure sensor temperature and modulo count	• Four digits left of decimal point: pressure sensor temperature counts, 0–4095 (2500 ~ 22 °C) • Four digits right of decimal point:modulo count that increments. Modulo count is 8-bit number from CTD that increments by count for each scan. If Deck Unit averages data, modulo count increments by number of scans averaged. This is a check on data. Maximum value to show is 255, then the count starts again.
11 [B]	CTD status	Four digits. From right to left: • pump status—1 = pump on, 0 = pump off • bottom contact switch status—1 = no contact. Switch is open or not installed. 0 = Switch is closed. • G.O. 1015 water sampler interface confirm signal or manual pump control signal —1 ~ 1.5 seconds = Deck Unit senses confirm signal from G.O. 1015 that show a bottle has been fired, 0 = no confirm signal sensed. OR 1 = Deck Unit senses manual pump control installed in 9plus, 0 = no manual pump control sensed. • CTD modem carrier sensed—0 = CTD modem senses Deck Unit modem carrier signal, 1 = not sensed.
12 [C]	Bytes available in IEEE488 buffer	Deck Unit puts data in a buffer at the rate it is collected, so the Deck Unit and PC operate somewhat independently. Data is transmitted from the buffer on command from PC. If PC takes too long to calculate and show data, the number of available bytes will decrease. If available bytes is less than an entire scan, the Overflow LED comes on a stays on until it receives a reset command. If the buffer overflows, some data will be lost.
13 [D]	Bytes available in RS232 buffer	
14 [E] 15 [F]	not used	—

7.2 Raw data format

7.2.1 IEEE488 data format

Data is in the order below.

- MSB = Most Significant Bit
- LSB = Least Significant Bit

Word	Byte	Description	Details
0	0-2	Primary temperature	Frequency f = (Byte 0×256) + Byte 1 + (Byte 2÷256)
	3-5	Primary conductivity	Frequency f = (Byte 3×256) + Byte 4 + (Byte 5÷256)
	6-8	Pressure	Frequency f = (Byte 6×256) + Byte 7+ (Byte 8÷256)
	9-11	Secondary temperature	Frequency f = (Byte 9×256) + Byte 10 + (Byte 11÷256)
	12-14	Secondary conductivity	Frequency f = (Byte 12×256) + Byte 13 + (Byte 14÷256)
5	15	A/D channel **0** (8 MSB)	Each 12-bit number (N) is a binary notation of analog voltage. N = 4095 for 0 V, 0 for 5 V. V = 5 (1 - [N ÷ 4095]) e.g.: byte 15 = **00110111**; byte 16 = **0100**1111 for A/D channel 0, N = 001101110100 = 884 decimal V = 5 (1 - [884 ÷ 4095]) = 3.921 V
	16	A/D channel **0** (4 LSB 4-7) **1** (4 MSB 0-3)	
	17	A/D channel **1** (8 MSB)	
6	18	A/D channel **2** (8 MSB)	
	19	A/D channel **2** (4 LSB 4-7) **3** (4 MSB 0-3)	
	20	A/D channel **3** (8 MSB)	
7	21	A/D channel **4** (8 MSB)	
	22	A/D channel **4** (4 LSB 4-7) **5** (4 MSB 0-3)	
	23	A/D channel **5** (8 MSB)	
8	24	A/D channel **6** (8 MSB)	
	25	A/D channel **6** (4 LSB 4-7) **7** (4 MSB 0-3)	
	26	A/D channel **7** (8 MSB)	
9	27	not used	Surface PAR: 12-bit number (N) is binary notation of analog voltage. N = 4095 for 0 V, 0 for 5 V. V = N ÷ 819 e.g.: byte 34 = 1111**0011** byte 35 = **01110100** N = **001101110100** = 884 decimal; V = 884 ÷ 819 = 1.079 V
	28	First 4 bits not used Surface PAR channel (4 MSB 0-3)	
	29	Surface PAR channel (8 LSB)	
10	30	Pressure sensor temperature (8 MSB)	Pressure sensor temperature: 12-bit number is binary notation of temperature from 0–4095. 2500 = approximately 22 °C. CTD status: • bit 0 Pump status—1 = pump on, 0 = pump off • bit 1 Bottom contact switch status—1 = switch open, 0 = switch closed • bit 2 G.O. 1015 water sampler interface confirm signal or manual pump control signal—1 = Deck Unit senses a confirm signal from G.O. 1015 or senses manual pump control installed in 9plus, 0 = not sensed • bit 3 CTD modem carrier—0 = CTD modem senses Deck Unit modem carrier signal, 1 = not sensed
	31	Pressure sensor temperature (4 LSB 4-7) CTD status (0-3)	
	32		8-bit number from CTD increases 1 count for each scan. If Deck Unit averages data, the modulo increases by the number of scans averaged. Modulo is a check on data integrity. Missing scans caused by sea cable errors cause "jumps" in the count.
end of scan		NMEA data	Refer to NMEA data format on page 40 for details

The Deck Unit suppresses words that are not used to save memory. This is based on how the system is configured. For example:

- If secondary temperature and conductivity are not used, words 3 and 4 can be suppressed from the data stream.
- If not all A/D channels are used those words can be suppressed in the data stream (words 5-8 as applicable). Words are suppressed from last to first—for a system with only two A/D voltage words, the channels are V0, V1, V2, and V3.
- If Surface PAR is not used, word 9 can be suppressed.

The Seasave software uses information in the configuration file to automatically command the Deck Unit to suppress words that are not used. For example, a system with a CTD only, with secondary temperature and conductivity, all A/D channels, and Surface PAR and no NMEA data, the IEEE488 output looks like:

Word	Byte	Description
0	0–2	Primary temperature
1	3–5	Primary conductivity
2	6–8	Pressure
3	9	Pressure sensor temperature (8 MSB)
	10	CTD status (4 LSB) Pressure sensor temperature (4 MSB)
	11	Modulo count (EOI line asserted)

7.2.2 RS232 data format

The data format for RS232 is almost the same as IEEE488, with three differences.

1. Each byte is sent as two ASCII-endoded characters. The first character is the hexadecimal notation of the most significant 4 bits. The second character is the hexadecimal notation of the least significant 4 bits.
   For example, a byte with a value of 42 (base 10) or 2A (hexadecimal) is sent as:
   First character—32 (ASCII for 2)
   Second character—41 (ASCII for A)
2. The two characters in the modulo count come after two pressure sensor temperature characters and two zero characters. The modulo characters are followed by a carriage return character (0D, base 16)and then a lined feed character (0A, base 16). The number of characters per scan:
   (words/scan × 3 bytes/word × 2 characters/byte) + 2 = 26 characters.
   For example, for a 4-word data stream:
   (4 words/scan × 3 bytes/word × 2 characters/byte) + 2 = 26 characters
3. NMEA data is on a line by itself, once per second, not appended to the end of each scan.

7.2.3 NMEA data format

For the IEEE488 interface, 7 bytes of position data are appended to the end of each CTD scan transmitted from the Deck Unit to the PC.

For the RS232 interface, 14 ASCII characters of position data, followed by a carriage return and line feel are transmitted once per second. For example, if the data collection rate is 24 Hz, the NMEA data is transmitted after CTD scans 1, 25, 49, etc. and scans in between will have only CTD data. In the Seasave software, the navigation data is appended to each CTD scan so the output from Seasave is the same for both IEEE488 and RS232.

The software calculates latitude and longitude as:

Latitude, degrees = (byte 1 × 65536 + byte 2 × 256 + byte 3) ÷ 50000.

Longitude, degrees = (byte 4 × 65536 + byte 5 × 256 + byte 6) ÷ 50000.

- If bit 1 in byte 7 is 1, this is a new position.
- If bit 8 in byte 7 is 1, latitude is negative.
- If bit 7 in byte 7 is 1, longitude is negative.
- North latitudes are positive; south latitudes are negative.
- East longitudes are positive; west longitudes are negative.

Example: Appended position data = 2455FC5D32B141
byte 1 = 24 hex = 36 decimal

byte 2 = 55 hex = 85 decimal

byte 3 = FC hex = 252 decimal

byte 4 = 5D hex = 93 decimal

byte 5 = 32 hex = 50 decimal

byte 6 = B1 hex = 177 decimal

byte 7 = 41 hex = 01000001 binary

This is a new position: bit 1 in byte 7 is 1.

Latitude is positive: bit 8 in byte 7 is 0.

Longitude is negative: bit 7 in byte 7 is 1.

Latitude = (36 × 65536 + 85 × 256 + 252) ÷ 50000 = 47.62616 degrees.

Longitude = (93 ×65536 + 50 × 256 +177) ÷ 50000 = -122.1565 degrees

7.2.4 Pressure frequency and pressure temperature data format

Pressure frequency and pressure temperature are transmitted in ASCII hex at the full CTD data rate of 24 Hz. Five bytes are transmitted ASCII-encoded, with each byte sent as two ASCII characters. A carriage return and line feed end each scan.

The first six characters show 3 bytes of pressure frequency:

Pressure frequency = byte[0] × 256 + byte[1] + byte[2] ÷ 256

The last three characters show the 12-bit pressure compensation number:

Pressure temperature = M × (12-bit compensation number) + B

Example: Raw pressure scan = 80E881A81<CR><LF>
byte[0] = 80 hex = 128 decimal

byte[1] = E8 hex = 232 decimal

byte[2] = 81 hex = 129 decimal

Pressure frequency = 128 × 256 +232 + 129 ÷ 256 = 33000.504 Hz

12-bit temperature compensation number = A81 hex = 2689 decimal

If M = 0.01258 × 2689 - 9.844 = 23.98 °C

7.2.5 Converted data output data format

If selected, the parameters below are transmitted in this order (Format < 128):

Parameter	Format	Units
Pressure	pppp.p	decibars
Depth	dddd.d	meters
Altimeter height	aaaa.a	meters
Temperature	tt.ttt	deg C
Conductivity	c.cccc	S/m

Salinity	ss.sss	PSU
Sound Velocity	vvvv.v	meters/second

Two spaces come after each parameter. Each scan of data ends with a carriage return, line feed.

7.3 Calculate engineering units in Seasave

The Seasave software lets the user select raw (frequencies and voltage) and converted data (decibars, °C, etc.) to show during data collection. The software applies calibration coefficients in the .xmlcon or .con file to the raw data to calculate engineering units.

The calibration sheet for each sensor lists its calibration coefficients as well as the equation used by the software to derive engineering units from the raw data.

The calculation of pressure temperature compensation for the Paroscientific Digiquartz pressure sensor is different, and described below.

T_D = M × (12-bit pressure temperature compensation word) +B

Where M = AD590M and B = AD590B from the calibration sheet.

Raw pressure temperature compensation has a decimal value between 0 and 4095.

Example:
Byte 30 = **10101000**; Byte 31 = **0001**0101

M = 0.01258 and B = -9.844 (from calibration sheet)

N = **1010100000001**binary = 2689 decimal

T_D = (0.01258 × 2689) -9.844 = 23.98 °C

Pressure temperature is calculated with a backward-looking 30-second running average to prevent bit transitions in pressure temperature to cause small jumps in calculated pressure. The pressure sensor is heavily insulated with a thermal time constant on the order on one hour, so the 30-second average does not change the calculated pressure temperature by much.

7.4 Calculate engineering units in Data Processing software

The SBE Data Processing software convert raw (hex) data into engineering units with the information in the configuration file, and then processes it. Even if the calibration coefficients in the configuration file were not correct, the saved raw data is correct and can be processed with the corrected calibration coefficients.

Section 8 Troubleshooting

⚠ DANGER

Life-threatening voltages of over 250 VDC are on the sea cable and the Deck Unit when it is on, and will persist for up to 1 minute after it is turned off.

This section lists some common problems with the Deck Unit and the most likely causes and solutions.

The manufacturer recommends that only experienced technicians do service work on the Deck Unit.

Make sure to remove the AC power cord and wait at least 1 minute to remove the housing or to change connectors.

8.1 Cannot see data in Seasave

If the scan length does not match the selected .xmlcon or .con file, data will not show in the Seasave display.

Solution

Stop data collection and make sure the settings in the *Configure Inputs* window of the software match the CTD configuration. Verify the number and type of auxiliary sensors, channels, NMEA, and Surface PAR.

The manufacturer recommends that the user enables the "Check scan length" in the Options menu of the software. If the scan length is different from the expected length, an error message will show.

If the configuration file is incorrect, it will not have an effect on the quality of the raw data. Correct any errors in the configuration file in the Data Processing software module and process the data as necessary.

8.2 Deck Unit does not operate

Cause

If the power switch is on but the power switch pilot light is off, no other panel lights are on and the fan does not operate, the AC power has been disconnected or the main fuse has blown.

Solution

Turn the Deck Unit off and remove the power cable. Wait 1 minute and look at the main fuse. Replace if necessary.

If the main fuse blows again, there may be a short in the main body wiring. There are separate fuses and short circuit protection circuitry related to the internal power supplies that protect the main fuse, even if internal circuitry does not turn on. It may be necessary to disconnect each section one by one to find the problem.

8.3 Deck Unit overflow light is on

Cause

Data from the CTD is transmitted to a RAM buffer in the Deck Unit. The PC tells the Deck Unit to transmit the data to the PC, and the buffer is then empty. If the PC is too slow to tell the Deck Unit to transmit the data in the buffer, the buffer overflows and the Overflow LED turns on.

Solution

An older, slow PC may be set to update the Seasave windows too often. To verify that this is the problem and change the settings on the PC, do the steps below.

1. Set the Deck Unit thumbwheel switch to 12 [C] (IEEE488) or 13 [D] (RS232) to show the number of bytes available in the Deck Unit buffer.
2. Start data collection. The number that shows in the Deck Unit LED should reset to 7000 (IEEE488) or 14000 (RS232) at regular intervals. If it does not, the buffer overflows. Stop data collection.
3. Change the Seasave display update rate: right-click in a **Display** window and select *Modify*. Enter a larger value in "Seconds between updates" then push **OK**. Do this for all **Display** windows. Do step 2 again. It may be necessary to do steps 2 and 3 two or three times.
4. In **Configure Outputs**, verify that *Serial Data Out* and *Shared File Out* are enabled. If yes, verify that "Seconds between updates" is a least 1 second.
5. Older, slow PCs may not be able to average data fast enough.Reduce the amount of data saved to the PC:
   - Set the software to average more scans. (An average of 1 is 24 Hz data, average of 2 is 12 Hz data, etc.) In **Configure Inputs**, change the configuration file in the *Instrument Configuration* tab to increase "Scans to average."
   - Supress data channels to reduce the amount of data per scan: in Configure Inputs, change the .xmlcon or .con file in the *Instrument Configuration tab.*

8.4 Cannot communicate with CTD

⚠ DANGER

Life-threatening voltages of over 250 VDC are on the sea cable and the Deck Unit when it is on, and will persist for up to 1 minute after it is turned off.

Cause

There is no voltage on the sea cable.

Solution

Turn the Deck Unit off. Remove the power cable and wait 1 minute. Connect a voltmeter set to a minimum of 300 VDC to the *Sea Cable* connector. Connect the power cable again and turn on the Deck Unit. The voltmeter should show 250 V.

If there is no voltage, the sea cable supply does not operate. Turn the Deck Unit off. Remove the power cable and wait 1 minute. Evaluate the *Sea Cable Fuse*. If this fuse is blown, the sea cable may have been accidentally shorted, or there is a malfunction of the CTD. If there is AC input, the fuse is ok. If there is no DC output, the power supply is defective.

The sea cable supply is built on two parallel aluminum rails that are immediately behind the main logic board of the Deck Unit. Make sure that there is 115/230 VAC input on the transformer primaries at T1, the large open frame unit at the left rear of the Deck Unit. There should be approximately 330 VDC across the large blue electrolytic C2 capacitor. If there is, make sure that the voltage across R1, the 4 K ohm, 11 watt bleeder resistor. If the voltage is correct at R1 and there is still no sea cable voltage, one of the leads to T1 may be broken. If the unregulated voltage at C2 is absent, the D1 bridge rectifier is probably defective.

8.5 Data LED does not turn on

Cause

The data LED does not turn on, but the Deck Unit transmits data to the PC. The wiring to the light or the light driver at U25 may be broken.

Cause

The data LED does not turn on and the Deck Unit does not transmit data to the PC.

Solution

1. Make sure that there is voltage at main internal supply turrets on the Digital PCB. Relative to the GND turret with the black wire, voltages should be (±0.5 V) +12 at orange, +5 at red, and -12 at blue. Voltage outside these ranges can be caused by a fault in the Power-One open-frame supply or an excessive load on one or more of the supply busses. Disconnect the red, orange, or blue lead to determine if the problem is in the power supply or on the power bus.
2. If the problem is with the power bus, connect the power supply leads again. Disconnect the ribbon cable connector at JP1 on the Digital PCB. If measured voltages are not correct the problem is with the Receiver/Modem PCB. If there is no change, the problem is probably in the Digital PCB logic board. Look for shorted bypass connectors, ICs (a shorted unit may be hot), etc.
3. If the power supply levels are correct, make sure the Receiver/Modem PCB operates correctly. With the CTD connected, look for a telemetry waveform on the "L" side of the Receiver/Modem PCB input terminal at J1. The Receiver/Modem PCB is under the main logic PCB. Remove the Deck Unit bottom cover to access this board.

8.6 RS232 does not work

Solutions

Select the SBE 11 Interface in the **Configure** menu of Seaterm. Verify that the baud rate is correct. A typical Deck Unit uses 19200 baud, 8 data bits, 1 stop bit, and no parity to communicate.

Verify that the commands transmitted by RS232 device are correct. For example, **GR** must be used to start to transmit data to the RS232 interface.

Verify that the connection to JP6, the RS232 I/O connector, is correctly attached. This connector can be attached 180 degrees to normal position, which reverses the RX and TX connections.

Evaluate the circuitry associated with U15 and U17.

8.7 IEEE488 does not work

Solutions

Make sure that the IEEE488 address is set to 1. This is the default, and is the required address for the Seasave software. If the interfaces requires a different address use **GPIB=N** to change the address

If non-Sea-Bird Scientific software is used, verify that the IEEE488 device transmits the correct commands to the Deck Unit. For example, GPIB=N must be used to start to transmit data to the IEEE488 interface.

Verify that the ribbon connector JP3, to the Digital PCB, is securely attached.

Evaluate the circuitry associated with U18.

8.8 Modem channel does not work

The Deck Unit and water sampler and/or the serial data output sensor connected to the CTD use the modem channel to communicate.

Solution

Verify test point TP2 on the CTD modem PCB with an oscilloscope. There should be a 1070 Hz sine wave with and amplitude of at least 50 MV peak-to-peak. The sine wave should change frequency when the CTD modem transmits characters.

Solution

Verify there is no signal. Put the Deck Unit thumbwheel switch in position 11[B]. With the CTD connected to the Deck Unit, the left-most bit should be 0. If it is 1, there is no signal.

Verify test point TP1 on the Deck Unit Receiver/Modem PCB. The sine wave should be 2225 Hz 4 V peak-to-peak.

8.9 Error message: unsupported modem

The error message `FFFFFFFF Unsupported modem message: xx xx xx` from the Carousel.

Causes

There may be noise on the line that causes extra characters to be transmitted.

The serial port for water sampler control may be incorrect.

The Carousel does not function correctly and sends bad messages.

Solutions

Verify there is no damage to the sea cable. Also verify the cable between the water sampler and the CTD is not damaged and is connected correctly.

In Seasave, make sure the serial port setting is correct. From **Configure Inputs**, go to the *Serial Ports* tab, then the Water Sampling and 911 Pump Control Serial Port area. This should be the port connected to the SBE 11plus *Modem Channel* connector.

8.10 Scan length error in Data Processing

Cause

The scan length in the data file does not match the selected .xmlcon or .con file. The Data Conversion module of the Data Processing software will not process the data.

Solution

In the Data Conversion module, go to the **Options** menu, then select Diagnostics. In the new window, select **Display Log File**. This shows the Diagnostics file and "scan length error" message. Look at the configuration file and the header in the data file and correct the configuration file as required.

8.11 NMEA Interface does not work

Solutions

Make sure that the cables and connections between the Deck Unit, the NMEA device, and the PC are correct.

Make sure that the NMEA device is set to either 4800 or 9600 baud. Use the **DS** command to verify that the NMEA Interface baud rate on the Deck Unit is correct. Reset the baud rate on the device if necessary.

If there is no data transmitted, refer to the manual for the device for setup details. To verify that the device can transmit data, connect an oscilloscope with ground on NMEA B (T17) and the probe on NMEA A (T16). This signal should be less than 0.5 V between messages and have pulses greater than 4 V for at least 0.2 milliseconds during the message.

To verify that the NMEA Interface does not operate correctly, use the NMEA Test program, which simulates a NMEA navigation device.

8.11.1 NMEA message simulation program

Part of the Seasoft V2 software, in the Data Processing module, is NMEA Test, a program to troubleshoot NMEA messages. The software simulates a NMEA navigation device that transmits messages in RMA, RMC, GLL, or CGA formats. If the system does not work with the NMEA navigation device but works with NMEA Test, the problem is with the interface cable from the NMEA navigation device to the Deck Unit, or in the NMEA navigation device.

The software is a simulation, and does not generate actual data. The baud rate (4800 or 9600) and the time between messages are user-programmable, as is the NMEA message format. The user can also specify a raw NMEA data file to use for the simulation. Refer to NMEA message format on page 20 for details.

The NMEA Test software requires a second PC to emulate the NMEA navigation device, or a spare COM port on the connected PC. Make sure the Deck Unit is connected to the CTD to test the NMEA interface. If it is not connected noise on the open *Sea Cable* connector will interfere with communication with the CTD.

Use the NMEA interface test cable to connect the Deck Unit NMEA to the simulation PC. Test cable connections:

MS3102A12S-3P	DB-9S	Function
Pin A	Pin 3	NMEA A, signal
Pin B	Pin 5	NMEA B, signal return

Use the software to test the NMEA communication:

1. On PC 1,use Seaterm to record the NMEA baud rate in the status command response. It needs to be 4800 or 9600.
2. On PC 2, start NMEA Test. The software is in the same directory as SBE Data Processing.
3. On the NMEA Test screen, select the **Configure** menu. In the *Configure* window, select:
   - NMEA message to be simulated, RMA, RMC, GLL, or CGA, or use a current NMEA data file: select Send File and navigate to the file you want to use.
   - Baud rate of 4800 or 9600. Make sure the Deck Unit baud rate is the same.
   - COM port on PC 2 to transmit the NMEA data to the Deck Unit.
   - Message interval, the time between simulated messages to be transmitted to the Deck Unit.

   Push **OK**.
4. Select **Start**. NMEA data should show on PC 2 each time the simulation program transmits a new position.
5. On PC 1, set up Seasave and start data collection. Data should show in Seasave.

The latitude and longitude that shows in Seasave should be the same as the simulation program for the raw and decoded NMEA message formats. If correctly decoded data shows, the NMEA Interface in the Deck Unit operates correctly. If the system works with the simulation program but does not work when connected to the actual NMEA navigation device, the problem is with the cable from the NMEA device to the Deck Unit, or in the NMEA navigation device itself.

- Verify that the cable pinouts are correct.
- If the cable is correct, verify that the NMEA navigation device is on and is configured to send data. Many NMEA devices have programmable NMEA outputs and may need to be configured before they will transmit NMEA messages. Refer to the documentation for the device for details.

Section 9 Command summary

General setup

Command	Description
DS	show status and setup parameters
GPIB=x	x=IEEE488 address. Default=1. Must be set to 1 to work with Seasave.
Advance Cn=x	n=conductivity channel, 0 or 1 x=time (seconds) to advance channel
AdvanceVn=x	n=A/D channel, 0–7 x=time (seconds) to advance channel. Maximum = 10.

NMEA

Command	Description
NMEABaud=x	x=baud rate for communication between Deck Unit and NMEA navigation device, 4800 or 9600
NSR	diagnostic use output Lat/Lon/Time ASCII data over RS232 SBE 11 interface to terminal program
NSI	diagnostic use output Lat/Lon/Time ASCII data over IEEE488 SBE 11 interface to terminal program
Nx	sent automatically by Seasave based on .xmlcon or .con file setting. x=Y: add 7 bytes of Lat/Lon data to CTD data x=N: do not

Surface PAR

Command	Description
AddSPAR=x	x=Y: add Surface PAR voltage data to CTD data x=N: do not
Offset=x	x=offset voltage used to adjust Surface PAR data for drift in Deck Unit electronics

Pressure Frequency and Pressure Temperature

Command	Description
PBaud=x	x=baud for pressure frequency and pressure temperature output from Deck Unit, 1200, 2400, 4800, 9600, or 19200

Autorun

Command	Description
Autorun=x	x=N: do not automatically start data collection on power on. Default x=Y: at power on, automatically start data collection, and do not send and show DS command
AddNMEA=x	affects operation if Autorun=Y x=Y: add Lat/Lon data to CTD data x=N: do not

Converted Data Output (CDO)

Commands are sent to the Deck Unit through the *Remote Out* connector using Seaterm. Commands TCalDate through AltScale are sent automatically when PROG11v2 is used.

- F = floating point number
- S = string with no spaces
- N = integer

Command	Description
DS	show CDO setup parameters
DC	show calibration coefficients
TCalDate=S	S=primary temperature calibration date
CCalDate=S	S=primary conductivity calibration date
PCalDate=S	S=pressure calibration date
TF0=F	F=primary temperature F0
TG=F	F=primary temperature G
TH=F	F=primary temperature H
TI=F	F=primary temperature I
TJ=F	F=primary temperature J
GC=F	F=primary conductivity G
CH=F	F=primary conductivity H
CI=F	F=primary conductivity I
CJ=F	F=primary conductivity J
CPC=F	F=primary conductivity pcor
CTC=F	F=primary conductivity tcor
CS=F	F=primary conductivity slope
PC1=F	F=pressure C1
PC2=F	F=pressure C2
PC3=F	F=pressure C3
PC1=F	F=pressure D1
PT1=F	F=pressure T1
PT2=F	F=pressure T2
PT3=F	F=pressure T3
PT4=F	F=pressure T4
PS=F	F=pressure slope
PO=F	F=pressure offset
PM=F	F=pressure M
PB=F	F=pressure B
AltVolt=N	N=CTD A/D voltage number for altimeter
AltScale=F	F=altimeter scale factor
Format=x	x=output format
Baud=x	x=baud rate for CDO, 300, 600, 1200, 2400, 4800, 9600, 19200 for SBE 46, must be 1200, 2400, 4800, 9600
NAvg=x	x=number of scans to average for CDO
Lat=x	x=latitude, degrees, to use in calculation of depth from pressure
Alarms=x	x=alarm enable parameter. Bottom contact=1, pressure=2, altimeter=4, add numbers for a combination of alarms to include
PEnable=x	x=pressure, decibars, to enable all alarms

PSet=x	x=pressure, decibars, to turn on pressure alarm
AltSet=x	x=distance above bottom, meters, to turn on altimeter alarm
AltHyst=x	x=maximum change in distance above the bottom, meters for altimeter hysteresis
Go or Run	diagnostic use transmit CDO data to terminal program

9.1 Commands sent automatically by Seasave

Seasave automatically sends the commands below to configure the Deck Unit at the start of real-time data collection. **If software other than Seasave is used, these commands must be sent in the order listed.**

All commands and data sent to the Deck Unit must be sent as ASCII characters. When the Deck Unit receives these commands it executes the function. All commands are kept until the user pushes the Reset button on the Deck Unit or new commands are sent.

The general format is **CRL**, *where*:

- C = command
- R = carriage return (not required)
- L = ASCII character for line feed (10 decimal or 0A hexidecimal).

Reset Data Buffers

Command	Description
R	reset and flush buffers. Does not put data into buffers, keeps all parameters the same any command except **Start Collecting Data** and **Stop Placing Data into Buffers** causes **Reset Data Buffers** to execute automatically, so the data first transmitted after the command will have new format

Unsuppress All Data Words

Command	Description
U	restore all words to data stream. Send once before an **Xn** command is sent

Number of Scans to Average

Command	Description
Axx	xx=scans averaged by Deck Unit, 1–50

Suppress Data Word

Command	Description
Xn	n=suppressed word number, hex. Channels can be erased from the data stream that is transmitted to the PC with **Xn**. For frequency channels, a word has 1 channel. For A/D, a word has 2 channels. This command reduces the size of the scan, and thus the space required to store data.

NMEA

If Seasave is used, the data to be suppressed and the addition of NMEA data is entered in the .xmlcon or .con file. The Deck Unit sends the appropriate Xn and Nx commands based on the settings in the configuration file.

Command	Description
Nx	x=y: add Lat/Lon data to CTD data x=n: do not

Start Collecting Data

Command	Description
Gx	x=I, R, or B commands the Deck Unit to put data into its buffers at a rate of the number of scans averaged. x=I: put data into IEEE488 buffer x=R: put data into RS232 buffer x=B: put data into both buffers the PC uses the appropriate bus protocol to get this data

Stop Placing Data into Buffers

Command	Description
S	data is not put into buffers. Send **S** to stop data collection

The Deck Unit automatically sends the following commands as applicable when the user pushes the **Home/Arm** and **Fire** buttons.

To SBE 32 Carousel

Command	Description
#SR	go to home position (position #1)
#SF	fire next position (sequential fire)
#SNx	fire position x (first position is 1)
	examples: #S2—fire position #2 #SN<—fire position #12

Replies	Description
6, !, 6	at home position
6, #, 6	received invalid bottle number
6, -, 6	did not confirm fire
6, 49, 6	fired bottle #2
6, 72, 6	fired bottle #24

G.O. 1015 Rosette to CTD

Command	Description
#ENBL	supply power to Rosette
#FIRE	remove power to Rosette, fire bottle

Replies	Description
#ENABLED	ready to fire bottle
#CONFIRM	bottle fire confirm pulse sensed

G.O. 1016 Rosette to CTD

Command	Description
#GH	go to home position
#GOx	set arm offset to x, go to home position
#GF	fire position, move to next position

#GNx	go to position x
	examples: #GN2—go to position #2 GN:—go to position #10

Replies	Description
7, Oxf2, 7	positioning error, return to home
7, Oxf4, 7	positioning error, could not find home
7, Oxc9, 7	ready to fire position #1, home
7, Oxca, 7	ready to fire position #2, home

Miscellaneous

These commands apply to a CTD with an optional control line on the Modem PCB. Use to control a device such as a pump, wired to the control line

Command	Description
#P0	control function off (line logic set low)
#P1	control function on (line logic set high)

Section 10 General information

⚠WARNING

This product can expose the user to chemicals with silica, crystalline (airborne particles of respirable size), which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information, go to www.P65Warnings.ca.gov.

Revised editions of this user manual are on the manufacturer's website.

10.1 Warranty

Refer to the manufacturer's website for warranty information (seabird.com/warranty).

10.2 Service and support

The manufacturer recommends that sensors be sent back to the manufacturer annually to be cleaned, calibrated, and for standard maintenance.
Refer to the website for FAQs and technical notes, or contact the manufacturer for support at support@seabird.com. Do the steps below to send a sensor back to the manufacturer.

1. Complete the online Return Merchandise Authorization (RMA) form or contact the manufacturer.
   Note: *The manufacturer is not responsible for damage to the sensor during return shipment.*
2. Remove all batteries from the sensor, if so equipped.
3. Remove all anti-fouling treatments and devices.
   Note: *The manufacturer will not accept sensors that have been treated with anti-fouling compounds for service or repair. This includes AF 24173 devices, tri-butyltin, marine anti-fouling paint, ablative coatings, etc.*
4. Use the sensor's original ruggedized shipping case to send the sensor back to the manufacturer.
5. Write the RMA number on the outside of the shipping case and on the packing list.
6. Use 3rd-day air to ship the sensor back to the manufacturer. Do not use ground shipping.
7. The manufacturer will supply all replacement parts and labor and pay to send the sensor back to the user via 3rd-day air shipping.

10.3 China RoHS disclosure table

Name of Part	Hazardous substance or element in product					
	Pb	Hg	Cd	Cr(VI)	PBB	PBDE
PCBs	X	O	O	O	O	O
Cables	X	O	O	O	O	O
Housing	O	O	O	O	O	O
Mounting hardware	O	O	O	O	O	O
Accessories	O	O	O	O	O	O
This table is compiled to the SJ/T 11364 standard.						
O: This hazardous substance is below the specified limits as described in GB/T 26572. X: This hazardous substance is above the specified limits as described in GB/T 26572.						

10.4 Spare parts and accessories

Part number	Description
17556	Deck Unit signal input cable, from slip rings to Deck Unit, 10 m
17557	Deck Unit signal input cable, from slip rings to Deck Unit, 20 m
17841	Deck Unit signal input cable, from slip rings to Deck Unit, 30 m
17912	Deck Unit signal input cable, from slip rings to Deck Unit, 50 m
50086	2-contact connector, Deck Unit sea cable input
801587	Test cable, 11/33/36 Deck Unit to 9/32/PDIM, 10 m
801422	NMEA test cable, DB9S to MS3106A, SBE 11p/33/36/45, 1.8 m
801429	Test cable, remote data output, DB9S to MS3106A, 1.8 m
171887	RS232 serial cable, DB9P to DB9S, 3 m
801367	Cable, QSR/QCR-2200 SPAR to Deck Unit 15 m
801368	Cable, QSR/QCR-2200 SPAR to Deck Unit 30 m
171890	RS232 serial data uplink cable, DB9P to DB9S, 3 m
17015	AC power cord, US standard, 2 m
17824	AC power cord, European plug, 2 m

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